ERCB Report 90-B
Volume 7

ERCB

Risk Approach

An Approach for Estimating Risk to Public Safety from Uncontrolled Sour Gas Releases

ERCB Supplemental Appendices to Volumes 5 and 6

October 1990

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Volume 7 - ERCB Supplemental Appendices to Volumes 5 and 6

There is one other Risk Volume

Volume 6
Risk Approach

An Approach for Estimating Risk to Public Safety From
Uncontrolled Sour Gas Releases

October 1990

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There are two groups of people that deserve recognition for assisting Concord Environmental Corporation in its assessment of the risk posed from an uncontrolled release of sour gas. They are the ERCB staff and the Scientific Advisory Board. The many extra hours of effort these people contributed is greatly appreciated:

The ERCB Staff

The project coordinator	**Lynda Holizki** who was assisted by many staff:
From the Environment Protection Department	**Jim Davis** who co-ordinated the data collection on well blowout and pipeline statistics and assisted Concord by developing spread sheets to handle the fault tree analysis.
	John Sutherland who spent many hours generating graphs for this document.
	Richard Wright and Ann Elahee who were responsible for report documentation.
From the Drilling and Production Department	**Bill Wylie** who provided both data and first hand knowledge on well blowouts. Bill presented a paper on well blowout and kick information at the 1990 SPE conference. Bill's work in this area was of valuable assistance.
	Amyn Visram who assisted Bill Wylie.
	Gordon Dunn and Darryl Hass (Darryl is now in the Oil Sands Department) who provided excellent feedback on the Concord fault tree approach. Darryl also contributed to the data collection.
	Hal Knox who provided advice at the early stages of the work.
From the Gas Department	**Harvey Halladay** who by understanding the ERCB data base and the issues of sour gas moved our understanding of the sour gas statistics significantly forward and improved the reliability of the sweet/sour data splits substantially.
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	Andy Warren who contributed his recent work on shallow gas reserves in the south eastern Alberta area.
From the Pipeline Department	**Alan Cassley, Gary Ziehr** and **Andrea Larson** who provided both pipeline rupture data and advice on the use of that data.
	Roger Creasey (formerly from the Pipeline department) who initially reviewed the rupture data and provided advice to Concord on its fault tree analysis.

The Scientific Advisory Board

Members of the Scientific Advisory Board were asked to sit on the Board for the expertise they brought to bear on the issues at hand. In some areas their own research provided the necessary science for Concord to develop the GASCON/GASRISK model. The backup documentation for this science is contained in this document. There are two technical papers by **David Wilson** and one by **Bob Rogers**. The ERCB wishes to acknowledge these contributions and thank both of these individuals for allowing the ERCB to include them here.

Appendix A

ERCB Statistical Data
on
Sweet and Sour:
Well Blowouts (Drilling, Non-Drilling and Producing Operations) and Pipeline Failures (Leaks and Ruptures)

ERCB Staff
Alan Cassley - Pipeline Department
Jim Davis - Environment Protection Department
Harvey Halladay - Gas Department
Darryl Hass - Oil Sands Department
Lynda Holizki - Environment Protection Department
Andrea Larson - Pipeline Department
Bill Wylie - Drilling and Production Department
Gary Ziehr - Pipeline Department

October 1990

1 Introduction

This document is a compilation of data from various departments within the Energy Resources Conservation Board. The departments who have contributed to this document include Gas, Environment Protection, Drilling and Production, and Pipelines. The data contained here were collected for use by both the ERCB staff and Concord Environmental Corporation (formerly Concord Scientific Corporation). Concord used some of this data in their report entitled "Risk Approach" Volume 6, 1990. The data was used to determine frequency of occurrences for events that could lead to a sour gas release as well as the frequency of a sour gas release itself.

It is hoped that the consolidation of this data in one place will allow the data to be used for other purposes.

2 Definitions

Both official and internal definitions are given for fluid type, mode or status of well and type of well. As well, definitions are given for structure of well (dual or triple zone). These are the definitions used by the ERCB.

2.1 Fluid Definitions

2.1.1 Official Definitions

Crude Oil (Act 1.(1)(f.1)	A mixture mainly of pentanes and heavier hydrocarbons that may be contaminated with sulphur compounds that is recovered or is recoverable at a well from an underground reservoir and that is liquid at the conditions under which its volume is measured or estimated, and includes all other hydrocarbon mixtures so recovered or recoverable except raw gas or condensate.
Gas Raw Gas (Act 1.(1)(s.1)	A mixture containing methane, other paraffinic hydrocarbons, nitrogen, carbon dioxide, hydrogen sulphide, helium and minor impurities, or some of them, which is recovered or is recoverable at a well from an underground reservoir and which is gaseous at the conditions under which its volume is measured or estimated.
Gas* (Act 1.(1)(j.1)	Raw gas is marketable gas or any constituent of raw gas, condensate, crude bitumen or crude oil that is recovered in processing and that is gaseous at the conditions under which its volume is measured or estimated. *Gas Well - A well which produces primarily gas from a pool or a portion of a pool wherein the hydrocarbon system is gaseous or exhibits a dew point on reduction of pressure, or any well so designated by the Board. (Regs. 1.020(2)12.)
Oil*	Condensate or crude oil, or a constituent of raw gas, condensate or crude oil that is recovered in processing, that is liquid at the conditions under which its volume is measured or estimated. *Oil - A well which produces primarily liquid hydrocarbons from a pool or portion of a pool wherein the hydrocarbon system is liquid or exhibits a bubble point on reduction of pressure, or any well so designated by the Board. (Regs. 1.020(2)8.)

Gas/Water	A hydrocarbon fluid which is mainly gaseous but contains a high concentration of water and is used for enhancing recovery purposes.
Undesignated	A fluid whose composition has not yet been determined.
Water	A fluid containing two parts hydrogen and one part oxygen.
Brine	A fluid consisting of water with a high concentration of salts.
Waste*	Any fluid or mixture of fluids that has little or no value that is to be disposes. *Waste Material - Water, rubbish, debris, drilling fluids, oil, oily waste, sand tailings or other products from a well, oil sands operation, tank, pipeline or other production installation. (Proposed Regs. 8.150(1)) *Waste Processing and Disposal Facility - A system or arrangement of tanks or other surface equipment receiving waste material for processing and disposition from any gas or oil field operations under the jurisdiction of the Board (Proposed Regs.)
Solvent	A mixture of natural gas liquids and/or gases used for hydrocarbon miscible enhanced recovery purposes.
Steam	Water in the vapour phase or a combination of the liquid and vapour phases.
Air	Normal meaning of air, a gaseous mixture composed mainly of nitrogen and oxygen.\
Synthetic Crude Oil	A mixture, mainly of pentanes and heavier hydrocarbons, that may contain sulphur compounds, that is derived from crude bitumen and that is liquid at the conditions under which its volume is measured or estimated, and includes all other hydrocarbon mixtures so derived.
CO2	Carbon Dioxode
Polymer	A fluid consisting of a polymer (a chemical in liquid or powder form) added to water to increase the fluid viscosity for enhanced recovery purposes.

N2	Nitrogen
LPG Liquid Petroleum Gases	C1, C2, C3, C4 or C5+ or any combination thereof in the liquid phase.
Crude Bitumen	A natural occurring viscous mixture, mainly of hydrocarbons heavier than pentane, that may contain sulphur compounds, and that in its naturally occurring viscous state will not flow to a well.

2.1.2 Internal Definitions

Crude Oil	A well which is or has been and would be capable of producing oil.
Gas	A well which is capable of producing mainly raw gas.
Oil	A well which produces primarily hydrocarbons (condensate, crude oil or raw gas) will only be classified if advised by Oil or Gas Departments.
Gas/Water	Where gas and water are both used for injection purposes.
Undesignated	The type of fluid has not been confirmed as yet.
Water	A well which is capable of producing water for injection to underground formations in accordance with a Board approved enhanced recovery or pilot scheme. Also used to identify fresh water or formation water in association with disposal, injection and drinking.
Brine	Capable of producing salt brine.
Waste	Used for disposal of wastes industrial or refinery.
Solvent	Used to identify steam injected in a formation in accordance with a Board approved enhanced recovery or pilot scheme.
Steam	Used to identify steam injected in a formation in accordance with a Board approved enhanced recovery or pilot scheme.
Air	Used to identify air injected in a formation in accordance with a Board approved enhanced recovery or pilot scheme.

Synthetic Crude	Synthetic crude oil manufactured from tar sands.
Carbon Dioxide	Used to identify carbon dioxide injected in a formation in accordance with a Board approved enhanced recovery or pilot scheme.
Polymer	Used to identify polymer injected in a formation in accordance with a Board approved enhanced recovery or pilot scheme.
Nitrogen	Used to identify nitrogen injected in a formation in accordance with a Board approved enhanced recovery or pilot scheme.
Liquid Petroleum Gas	Usually related to storage.
Crude Bitumen	Oil produces from well within Oil Sands Areas.

2.2 Mode Definitions

2.2.1 Official Definitions

Suspended	A well in which operations have ceased for an indefinite amount of time and for which notification has been received by Board Form S-4.
Abandoned	A well which is officially abandoned.
Abandoned Zone	A zone that has been abandoned; at least one other event sequences exists.
Abandoned and Re-entered	A well that was abandoned and later re-entered with a new event sequence.
Capped	A well with proven productivity (by test or judgement) but has not been placed on production.
Potential	A well in which productivity or injectivity is assumed but not proven.
Standing	A well drilled and cased but has not been given a recognized status.

Junked Abandoned	A well abandoned because of mechanical difficulties in the well bore.
Closed	A well shut in by Board "C" Order.
Flowing	A well capable of producing fluids to surface by its own formation pressure.
Pumping	A producing well using mechanical equipment to lift fluids to surface.
Gas Lift	A producing well in which gas injected into the tubing/casing annulus is used to lift liquids in the tubing with or without a travelling piston.
Testing	A well being evaluated for potential fluid production or injection. This involves observing pressures or flow rates in response to producing or injection into the well.
Abandoned and Whipstocked	A well drilled and plugged back and another hole drilled and whipstocked out of the same well bore.

2.2.2 Internal Definitions

Suspended	Operations suspended.
Abandoned	A well that is plugged.
Abandoned Zone	A zone that has been in a multizone well.
Abandoned and Re-entered	A well that was abandoned but later re-entered a new event sequence is set up.
Capped	A well that is completed for production but no flow line or market available.
Potential	A well in which productivity or injectivity is assumed but not proved.
Standing	A well that has finished drilling but have received no official status.
Junked and Abandoned	A well that was abandoned due to mechanical problems before reaching its objective.
Closed	Shut in by Board Order.

Flowing	A well producing by means of formation pressures.
Pumping	A well which has pumping facilities for production purposes.
Gas Lift	A well recycling gas to facilitate oil production.
Testing	A well that is being evaluated for production.
Abandoned and Whipstocked	A well drilled and plugged back and another hole drilled and whipstocked out of the same well bore.

2.3 Type Definitions

2.3.1 Official Definitions

Reproducer	A well used to produce hydrocarbons from storage.
Storage	A well to inject fluids (hydrocarbons) for storage in a reservoir, cavern, or aquifer.
Injection	A well used primarily to inject fluids into a formation in accordance with a Board approved enhanced recovery, experimental or pilot scheme.
Disposal	A well used for the disposal of oil field waste fluids or produced water into a reservoir or aquifer (includes gas plant process water) in accordance with a Board approval.
Observation	A well used to monitor performance in an oil sands deposit, pool, or aquifer.
Training	A well used for training purposes.
Experimental Well	Means a well drilled being drilled or operated pursuant to an experimental scheme approved by the Board.
Farm	A well used to supply hydrocarbons to a local farm for utility purposes.

Industrial	A well used for the disposal of processing wastes from a refinery or chemical plant, brine from preparation or operation of a storage cavern in accordance with a Board approval. (Requires Ministerial approval)
Cyclical	A well used to sequentially inject energy in form of fluid and produce hydrocarbon.

2.3.2 Internal Definitions

Reproducer	A well that reproduces stored liquids example (Gas).
Storage	A well used to store Gas or Oil for future use.
Injection	A well used to inject fluids into for different purposes.
Disposal	A well whose primary purpose is to dispose of water produced from Oil or Gas well.
Observation	Used to monitor pool performance example (pressure, etc.)
Training	Used for training oil personnel example (logging, etc.)
Experimental	Experimental recovering of hydrocarbons.
Farm	For domestic use.
Industrial	For industrial waste.
Cyclical	A well that is alternating between steaming and producing.

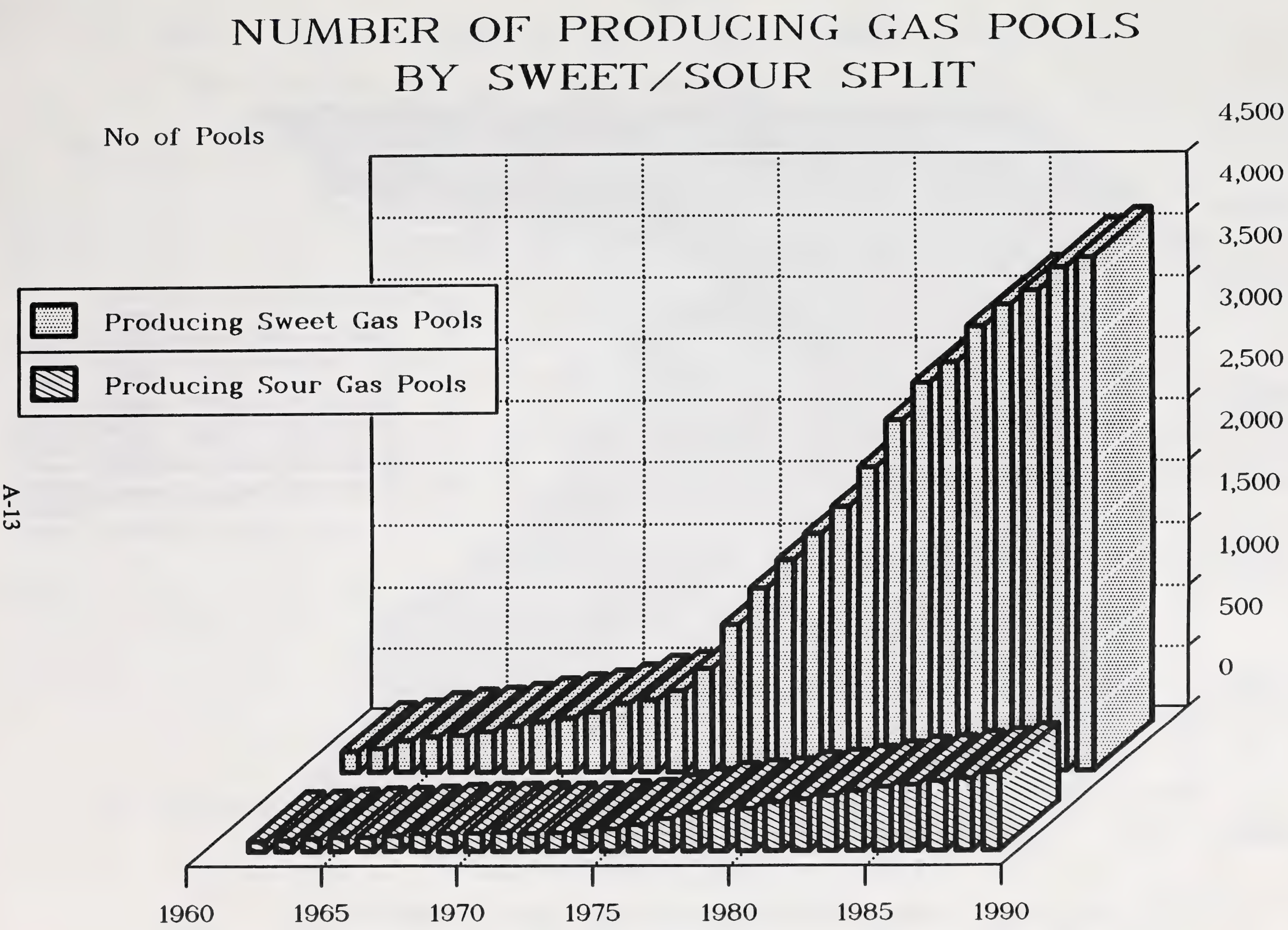
2.4 Structure Definitions

Dual Zone	Open zone in a well which has two open zones.
Triple Zone	Open zone in a well which has three open zones.

3 Provincial Summary Statistics for Wells

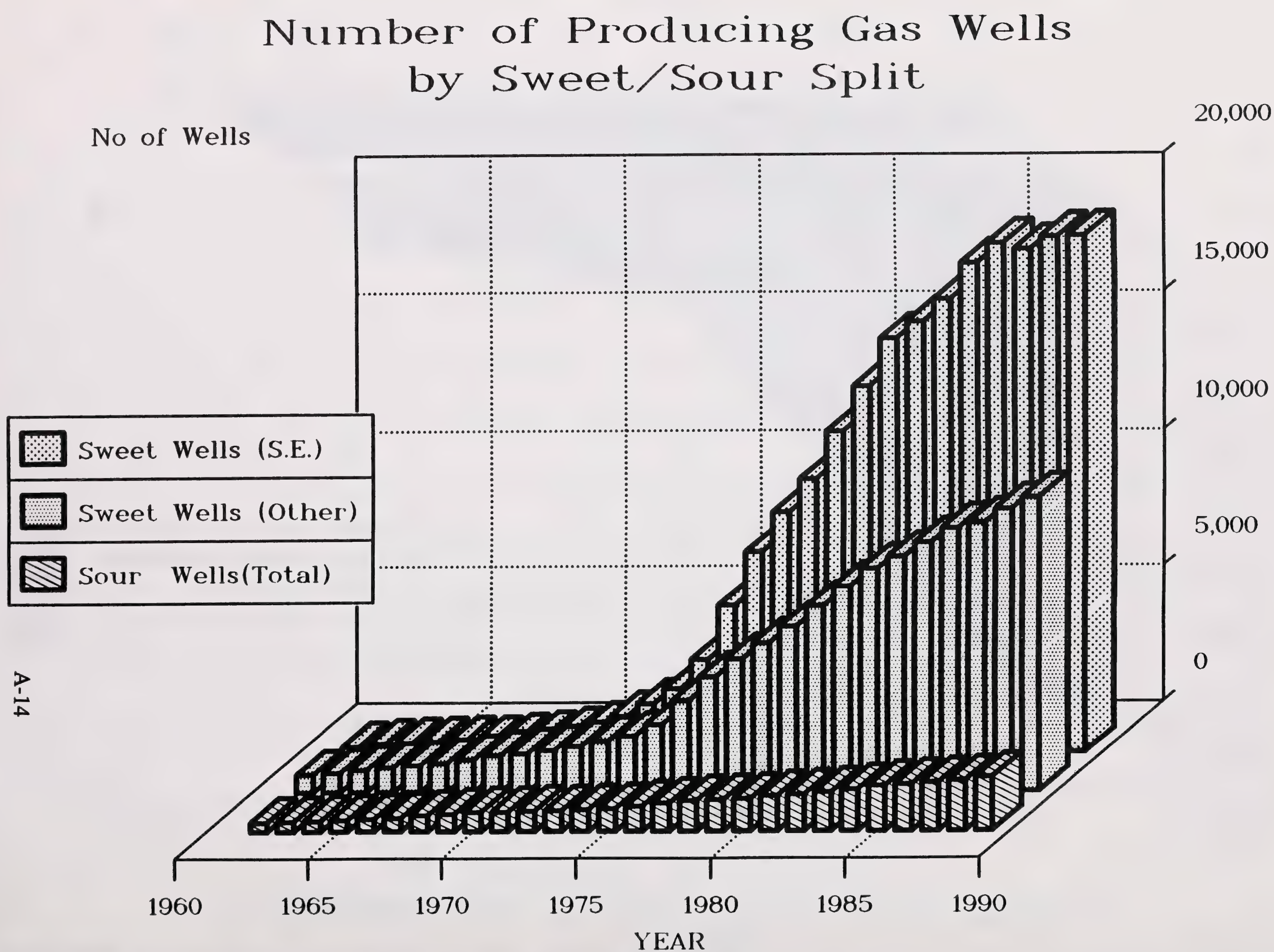
These tables were provided by the Gas Department. The information is contained in the sour well data base and well data file.

These tables all supply the sweet/sour splits for their respective categories.



NUMBER OF PRODUCING GAS POOLS
BY SWEET/SOUR SPLIT
No of Pools
Producing Sweet Gas Pools
Producing Sour Gas Pools
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1960
1965
1970
1975
1980
1985
1990
YEAR

FIGURE 3.1



Number of Producing Gas Wells
by Sweet/Sour Split
No of Wells
20,000
15,000
10,000
5,000
0
Sweet Wells (S.E.)
Sweet Wells (Other)
Sour Wells(Total)
1960
1965
1970
1975
1980
1985
1990
YEAR

FIGURE 3.2

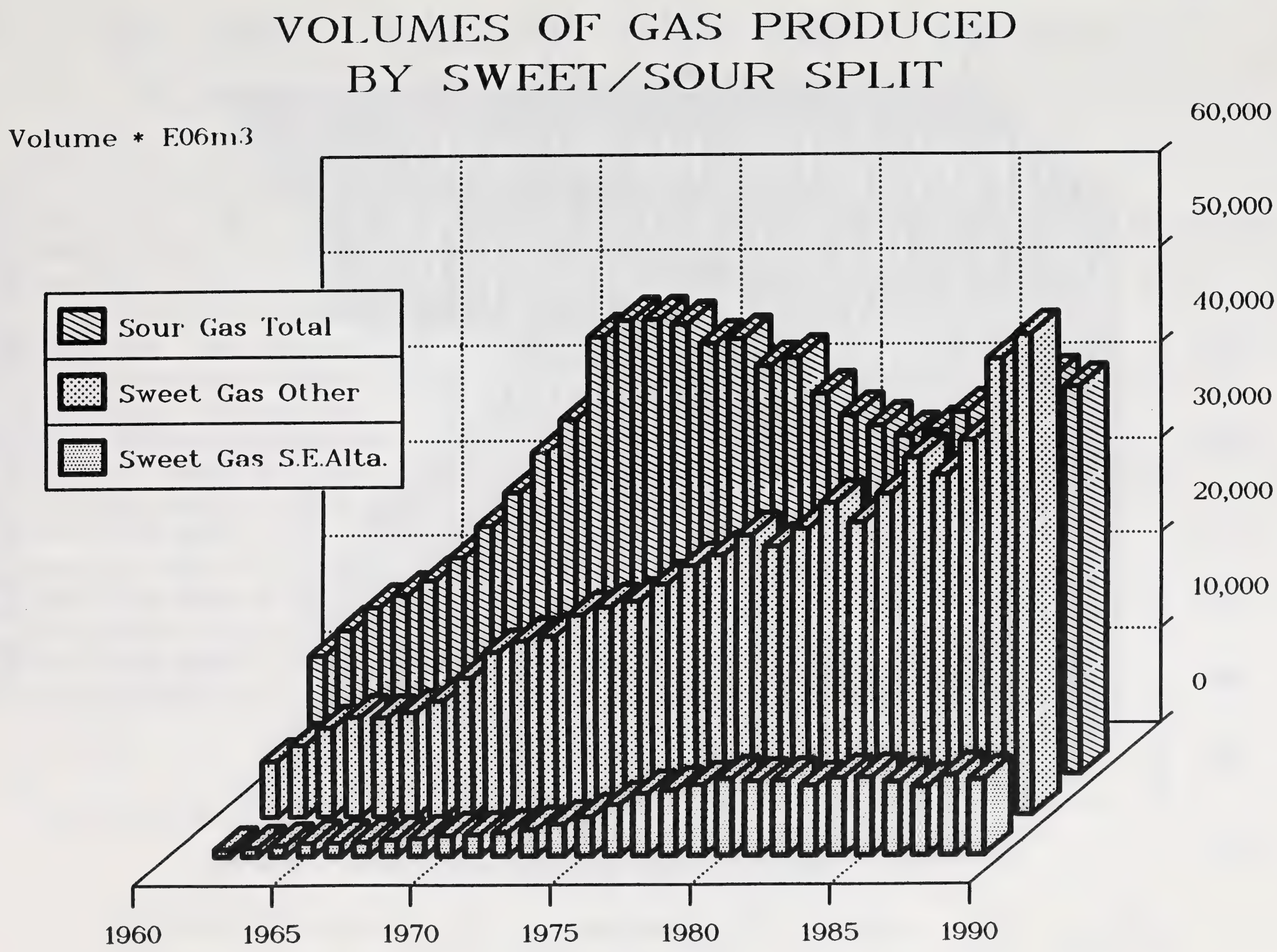


FIGURE 3.3

VOLWELL

Distribution of Producing Sour Gas Wells by H2S Content

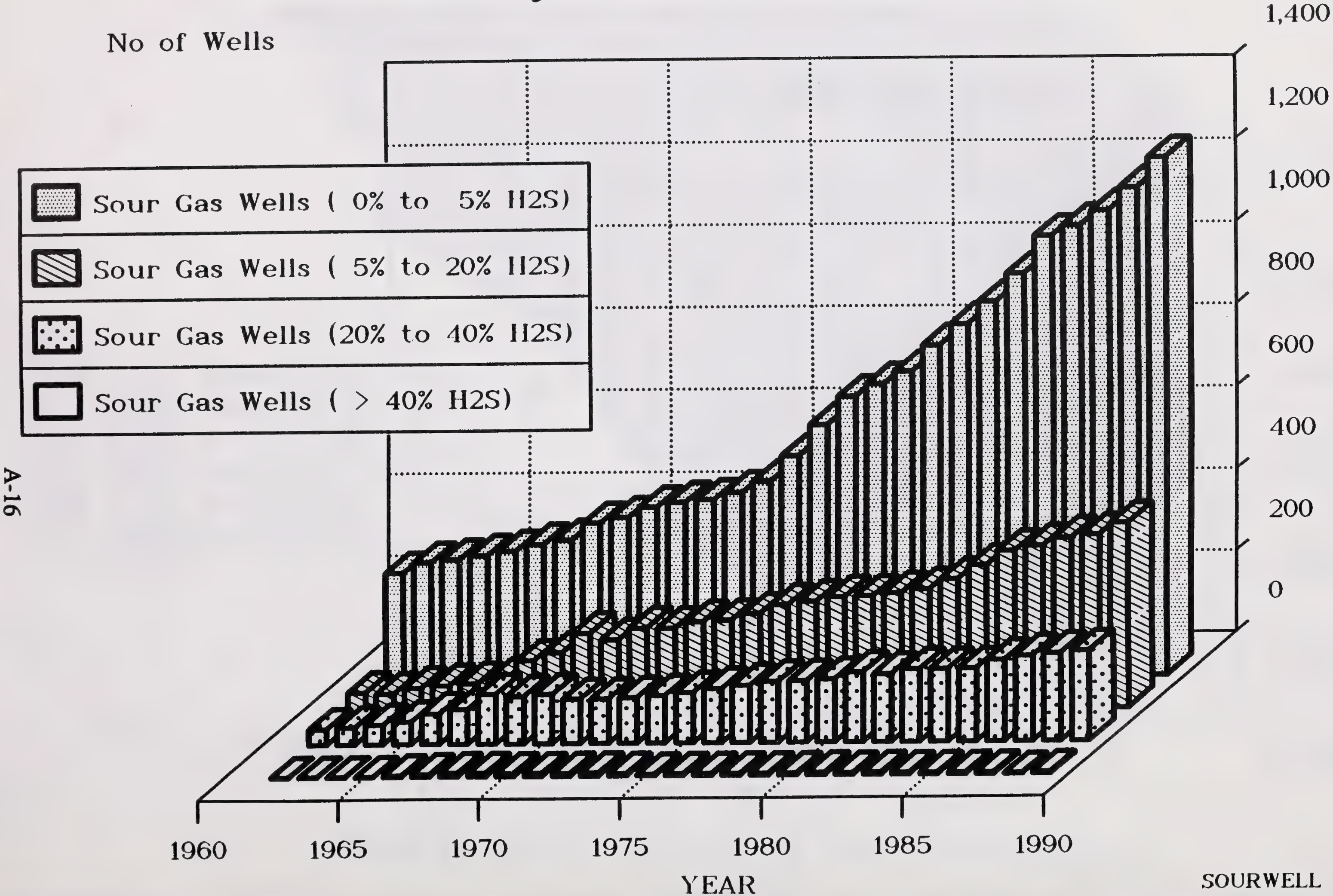


FIGURE 3.4

Distribution of Sour Gas Volumes by H2S Content

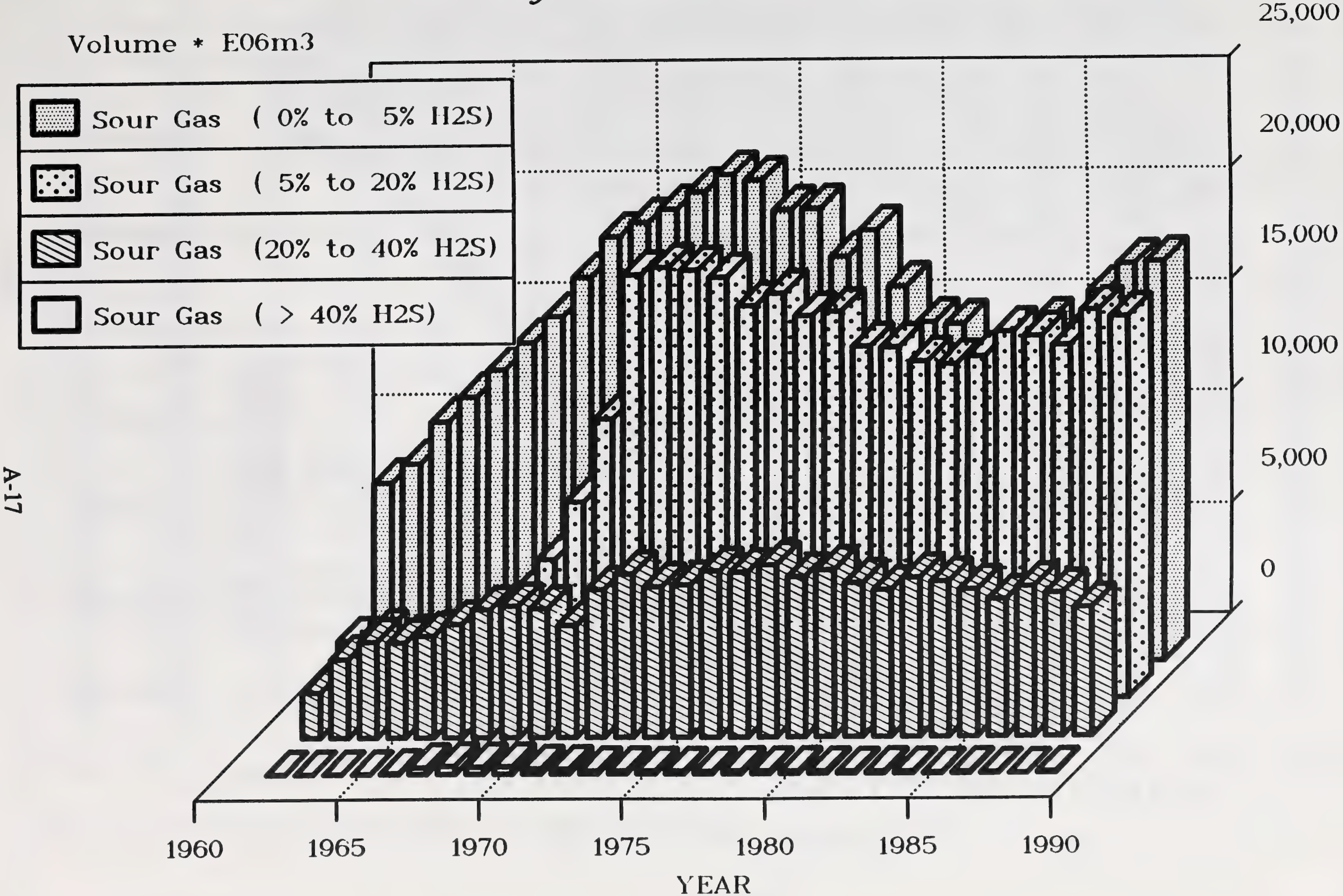


FIGURE 3.5

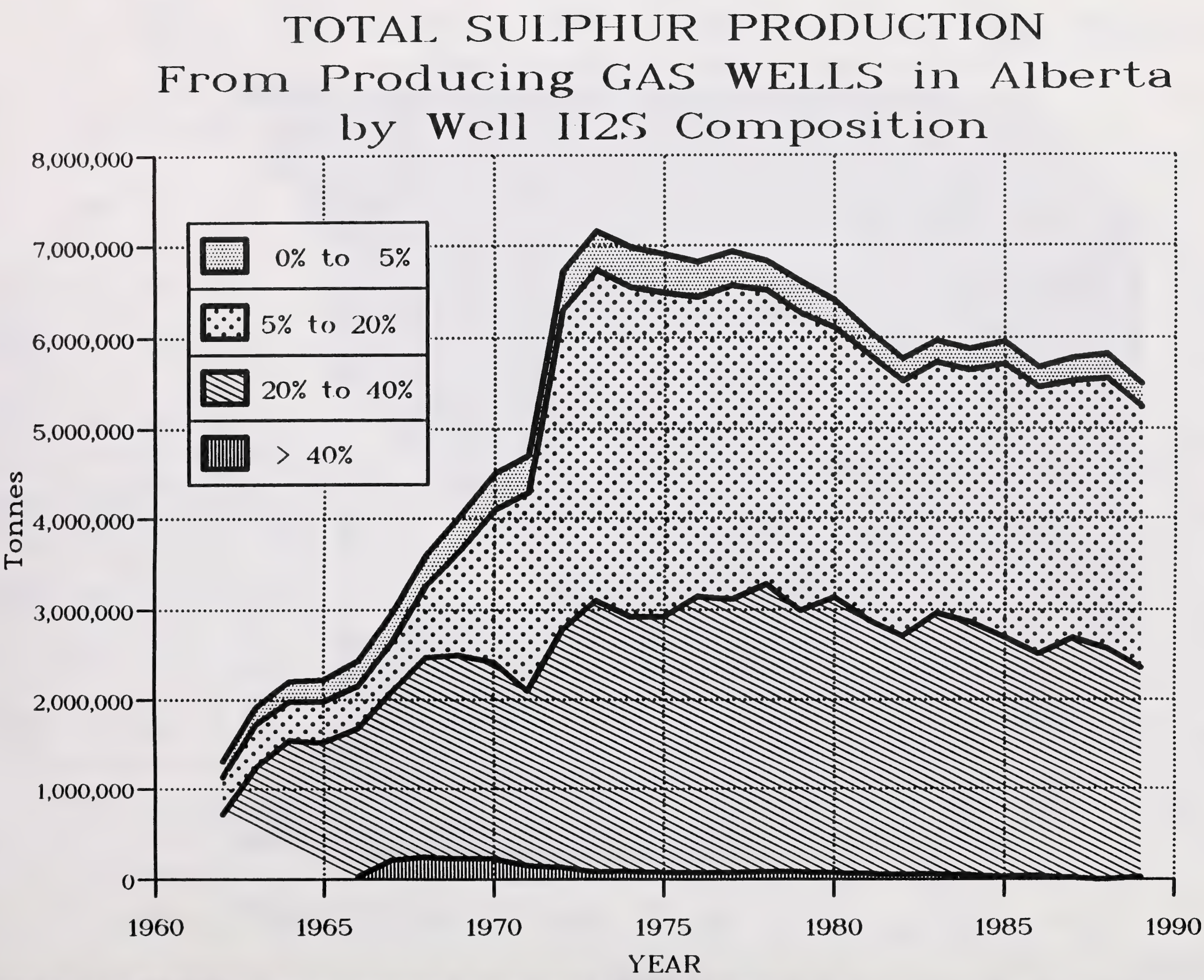


FIGURE 3.6

SULPLINE

TABLE 3.1

SUMMARY OF EVENT STATISTICS

YEAR	GAS						OIL			OTHER			TOTAL		
	SWEET	LVL=1	LVL=2	LVL=3	LVL=4	TOTAL	SWEET	SOUR	TOTAL	SWEET	SOUR	TOTAL	SWEET	SOUR	TOTAL
PRE 1951	648	425	2	1	0	1,076	450	1,622	2,072	3,495	118	3,613	4,593	2,168	6,761
1951	213	72	3	1	0	289	270	550	820	402	30	432	885	656	1,541
1952	297	64	5	2	0	368	468	505	973	604	38	642	1,369	614	1,983
1953	269	70	7	3	0	349	440	352	792	604	19	623	1,313	451	1,764
1954	283	33	6	1	0	323	428	190	618	454	15	469	1,165	245	1,410
1955	528	38	7	2	1	576	677	156	833	419	14	433	1,624	218	1,842
1956	518	48	4	4	2	576	879	191	1,070	499	14	513	1,896	263	2,159
1957	329	74	7	5	4	419	580	169	749	739	15	754	1,648	274	1,922
1958	486	77	14	4	4	585	637	200	837	963	23	986	2,086	322	2,408
1959	518	55	13	5	1	592	645	85	730	786	17	803	1,949	176	2,125
1960	524	101	11	6	7	649	666	58	724	684	15	699	1,874	198	2,072
1961	486	118	11	5	5	625	624	70	694	613	29	642	1,723	238	1,961
1962	434	72	16	4	1	527	543	73	616	821	13	834	1,798	179	1,977
1963	379	81	8	5	1	474	633	186	819	800	22	822	1,812	303	2,115
1964	424	67	7	4	2	504	663	129	792	1,050	34	1,084	2,137	243	2,380
1965	415	69	16	10	2	512	715	97	812	1,201	26	1,227	2,331	220	2,551
1966	382	116	20	8	4	530	436	156	592	950	40	990	1,768	344	2,112
1967	362	203	27	11	6	609	360	362	722	814	83	897	1,536	692	2,228
1968	540	170	21	17	18	766	316	339	655	1,064	86	1,150	1,920	651	2,571
1969	563	122	21	14	17	737	272	203	475	1,059	49	1,108	1,894	426	2,320
1970	758	107	17	7	16	905	264	88	352	989	23	1,012	2,011	258	2,269
1971	1,016	92	11	6	3	1,128	283	108	391	1,122	30	1,152	2,421	250	2,671
1972	1,493	119	10	2	2	1,626	409	99	508	1,388	33	1,421	3,290	265	3,555
1973	2,242	133	10	2	0	2,387	530	73	603	1,863	51	1,914	4,635	269	4,904
1974	2,352	121	11	2	3	2,489	587	84	671	2,148	25	2,173	5,087	246	5,333
1975	2,792	157	16	3	6	2,974	677	49	726	1,565	38	1,603	5,034	269	5,303
1976	4,633	283	14	3	2	4,935	590	74	664	1,431	43	1,474	6,654	419	7,073
1977	4,426	283	14	6	3	4,732	712	107	819	1,612	53	1,665	6,750	466	7,216
1978	4,474	335	24	2	0	4,835	881	146	1,027	1,807	60	1,867	7,162	567	7,729
1979	4,603	402	16	3	1	5,025	1,054	249	1,303	1,702	74	1,776	7,359	745	8,104
1980	5,680	461	16	2	2	6,161	1,371	238	1,609	2,400	125	2,525	9,451	844	10,295
1981	4,221	358	12	4	2	4,597	1,118	217	1,335	2,939	140	3,079	8,278	733	9,011
1982	3,432	249	5	2	0	3,688	1,264	301	1,565	1,945	101	2,046	6,641	658	7,299
1983	1,587	210	7	4	0	1,808	1,537	425	1,962	1,946	76	2,022	5,070	722	5,792
1984	1,993	255	3	3	0	2,254	1,966	492	2,458	2,645	112	2,757	6,604	865	7,469
1985	3,107	302	7	1	1	3,418	2,206	567	2,773	3,923	147	4,070	9,236	1,025	10,261
1986	1,431	283	13	1	3	1,731	1,304	402	1,706	1,888	87	1,975	4,623	789	5,412
1987	1,317	278	8	1	5	1,609	1,632	478	2,110	2,241	103	2,344	5,190	873	6,063
1988	1,846	446	6	2	0	2,300	1,529	681	2,210	3,062	135	3,197	6,437	1,270	7,707
1989	695	165	0	0	0	860	689	392	1,081	2,502	69	2,571	3,886	626	4,512
1990	13	0	0	0	0	13	13	5	18	329	0	329	355	5	360
TOTAL	62,709	7,114	446	168	124	70,561	31,318	10,968	42,286	59,468	2,225	61,693	153,495	21,045	174,540

NOTES: "YEAR" IS BASED ON THE FINISHED DRILLING DATE OF THE WELL.

TABLE 3.2

SUMMARY OF BOREHOLE STATISTICS

YEAR	GAS SWEET	GAS LVL=1	GAS LVL=2	GAS LVL=3	GAS LVL=4	GAS TOTAL	OIL SWEET	OIL SOUR	OIL TOTAL	OTHER SWEET	OTHER SOUR	OTHER TOTAL	TOTAL SWEET	TOTAL SOUR	TOTAL TOTAL
PRE1951	933	406	2	1	0	1,342	822	1,512	2,334	2,542	105	2,647	4,297	2,026	6,323
1951	161	59	3	1	0	224	229	497	726	326	27	353	716	587	1,303
1952	218	57	5	2	0	282	464	434	898	519	34	553	1,201	532	1,733
1953	202	64	7	3	0	276	392	315	707	553	18	571	1,147	407	1,554
1954	165	25	6	1	0	197	408	166	574	491	13	504	1,064	211	1,275
1955	146	37	7	2	1	193	666	128	794	706	13	719	1,518	188	1,706
1956	185	41	4	4	2	236	819	169	988	765	13	778	1,769	233	2,002
1957	196	56	7	5	4	268	536	140	676	790	11	801	1,522	223	1,745
1958	240	68	13	4	4	329	605	177	782	1,081	21	1,102	1,926	287	2,213
1959	305	46	13	5	1	370	623	78	701	822	16	838	1,750	159	1,909
1960	278	84	11	6	5	384	704	53	757	699	12	711	1,681	171	1,852
1961	266	89	11	5	5	376	605	57	662	632	25	657	1,503	192	1,695
1962	299	59	16	4	1	379	540	64	604	748	13	761	1,587	157	1,744
1963	287	68	8	5	1	369	580	152	732	740	18	758	1,607	252	1,859
1964	339	56	7	4	2	408	629	114	743	964	32	996	1,932	215	2,147
1965	326	63	16	9	2	416	693	72	765	1,118	24	1,142	2,137	186	2,323
1966	263	88	20	8	4	383	461	96	557	869	29	898	1,593	245	1,838
1967	283	151	27	11	6	478	364	168	532	755	41	796	1,402	404	1,806
1968	388	137	21	17	18	581	365	195	560	952	59	1,011	1,705	447	2,152
1969	435	95	21	14	17	582	342	123	465	923	42	965	1,700	312	2,012
1970	581	85	17	7	16	706	305	65	370	873	20	893	1,759	210	1,969
1971	747	77	11	6	3	844	275	62	337	1,055	26	1,081	2,077	185	2,262
1972	1,057	108	10	2	2	1,179	409	73	482	1,376	27	1,403	2,842	222	3,064
1973	1,425	110	9	2	0	1,546	524	65	589	1,976	45	2,021	3,925	231	4,156
1974	1,512	104	11	2	3	1,632	549	64	613	2,291	22	2,313	4,352	206	4,558
1975	1,602	134	14	3	6	1,759	657	40	697	1,865	31	1,896	4,124	228	4,352
1976	2,474	219	14	3	2	2,712	601	59	660	1,911	37	1,948	4,986	334	5,320
1977	2,371	230	13	6	3	2,623	647	95	742	2,087	46	2,133	5,105	393	5,498
1978	2,506	278	24	2	0	2,810	744	121	865	2,231	52	2,283	5,481	477	5,958
1979	2,349	336	14	3	1	2,703	906	201	1,107	2,157	65	2,222	5,412	620	6,032
1980	2,972	379	16	2	2	3,371	1,109	187	1,296	2,960	104	3,064	7,041	690	7,731
1981	2,171	284	12	4	2	2,473	905	170	1,075	3,321	121	3,442	6,397	593	6,990
1982	1,964	213	5	2	0	2,184	989	231	1,220	2,179	78	2,257	5,132	529	5,661
1983	937	186	6	4	0	1,133	1,137	332	1,469	2,109	68	2,177	4,183	596	4,779
1984	1,135	216	3	3	0	1,357	1,506	404	1,910	2,941	93	3,034	5,582	719	6,301
1985	1,799	266	7	1	1	2,074	1,786	477	2,263	4,142	122	4,264	7,727	874	8,601
1986	805	228	13	1	3	1,050	1,120	333	1,453	1,998	70	2,068	3,923	648	4,571
1987	763	231	8	1	5	1,008	1,338	428	1,766	2,416	84	2,500	4,517	757	5,274
1988	1,115	381	6	2	0	1,504	1,353	617	1,970	3,134	110	3,244	5,602	1,116	6,718
1989	930	146	0	0	0	1,076	743	366	1,109	1,943	61	2,004	3,616	573	4,189
1990	77	0	0	0	0	77	60	5	65	218	0	218	355	5	360
TOTAL	37,207	5,960	438	167	122	43,894	28,510	9,105	37,615	62,178	1,848	64,026	127,895	17,640	145,535

NOTES: "YEAR" IS BASED ON THE FINISHED DRILLING DATE OF THE WELL.
A BOREHOLE IS DESIGNATED AS GAS, OIL OR OTHER ON THE FOLLOWING BASIS:
- IF THE WELL CONTAINS ONE SOUR EVENT, THE WELL IS DESIGNATED ACCORDING TO THE CATEGORY OF THE SOUR EVENT.
- IF THE WELL CONTAINS MULTIPLE SOUR EVENTS, THE PRIORITY: GAS,OIL,OTHER IS USED FOR ONLY THE SOUR EVENTS.
- IF THE WELL CONTAINS ONLY SWEET EVENTS, THE BWD WELL STATUS IS USED AND THE GAS, OIL, OTHER PRIO[illegible]Y IS USED FOR MULTIPLE EVENT WELLS.

TABLE 3.3

SUMMARY OF BOREHOLE STATISTICS (WITH DOUBLE COUNTING)

	GAS						OIL			OTHER			TOTAL		
YEAR	SWEET	LVL=1	LVL=2	LVL=3	LVL=4	TOTAL	SWEET	SOUR	TOTAL	SWEET	SOUR	TOTAL	SWEET	SOUR	TOTAL
PRE1951	450	406	2	1	0	859	395	1,529	1,924	3,494	118	3,612	4,339	2,056	6,395
1951	140	59	3	1	0	203	210	503	713	400	29	429	750	595	1,345
1952	210	57	5	2	0	274	420	445	865	603	36	639	1,233	545	1,778
1953	193	64	7	3	0	267	377	326	703	604	19	623	1,174	419	1,593
1954	241	25	6	1	0	273	392	168	560	454	15	469	1,087	215	1,302
1955	466	37	7	2	1	513	650	129	779	419	14	433	1,535	190	1,725
1956	454	41	4	4	2	505	845	170	1,015	498	14	512	1,797	235	2,032
1957	284	56	7	5	4	356	536	143	679	738	12	750	1,558	227	1,785
1958	410	68	13	4	4	499	579	181	760	959	23	982	1,948	293	2,241
1959	431	46	13	5	1	496	582	80	662	776	17	793	1,789	162	1,951
1960	413	84	11	6	5	519	622	56	678	681	15	696	1,716	177	1,893
1961	384	89	11	5	5	494	559	60	619	609	28	637	1,552	198	1,750
1962	333	59	16	4	1	413	484	65	549	819	13	832	1,636	158	1,794
1963	302	68	8	5	1	384	539	160	699	793	22	815	1,634	264	1,898
1964	324	56	7	4	2	393	603	118	721	1,047	34	1,081	1,974	221	2,195
1965	330	63	16	9	2	420	659	74	733	1,192	25	1,217	2,181	189	2,370
1966	293	88	20	8	4	413	383	109	492	946	39	985	1,622	268	1,890
1967	288	151	27	11	6	483	320	191	511	812	72	884	1,420	458	1,878
1968	403	137	21	17	18	596	263	209	472	1,062	79	1,141	1,728	481	2,209
1969	421	95	21	14	17	568	244	128	372	1,054	48	1,102	1,719	323	2,042
1970	583	85	17	7	16	708	222	66	288	987	23	1,010	1,792	214	2,006
1971	751	77	11	6	3	848	247	64	311	1,115	29	1,144	2,113	190	2,303
1972	1,138	108	10	2	2	1,260	362	78	440	1,386	30	1,416	2,886	230	3,116
1973	1,669	110	9	2	0	1,790	477	66	543	1,849	50	1,899	3,995	237	4,232
1974	1,754	104	11	2	3	1,874	520	69	589	2,140	25	2,165	4,414	214	4,628
1975	1,994	134	14	3	6	2,151	629	43	672	1,555	35	1,590	4,178	235	4,413
1976	3,171	219	14	3	2	3,409	512	63	575	1,414	42	1,456	5,097	343	5,440
1977	3,028	230	13	6	3	3,280	592	98	690	1,595	51	1,646	5,215	401	5,616
1978	3,087	278	24	2	0	3,391	731	124	855	1,793	58	1,851	5,611	486	6,097
1979	3,030	336	14	3	1	3,384	866	206	1,072	1,679	73	1,752	5,575	633	6,208
1980	3,762	379	16	2	2	4,161	1,120	196	1,316	2,350	117	2,467	7,232	712	7,944
1981	2,829	284	12	4	2	3,131	908	176	1,084	2,869	131	3,000	6,606	609	7,215
1982	2,317	213	5	2	0	2,537	1,072	236	1,308	1,902	95	1,997	5,291	551	5,842
1983	1,146	186	6	4	0	1,342	1,318	341	1,659	1,883	73	1,956	4,347	610	4,957
1984	1,454	216	3	3	0	1,676	1,714	415	2,129	2,591	107	2,698	5,759	744	6,503
1985	2,045	266	7	1	1	2,320	1,973	487	2,460	3,882	140	4,022	7,900	902	8,802
1986	967	228	13	1	3	1,212	1,198	342	1,540	1,866	81	1,947	4,031	668	4,699
1987	893	231	8	1	5	1,138	1,496	430	1,926	2,222	97	2,319	4,611	772	5,383
1988	1,280	381	6	2	0	1,669	1,394	628	2,022	3,030	127	3,157	5,704	1,144	6,848
1989	535	146	0	0	0	681	647	371	1,018	2,459	65	2,524	3,641	582	4,223
1990	13	0	0	0	0	13	13	5	18	329	0	329	355	5	360
TOTAL	44,216	5,960	438	167	122	50,903	27,673	9,348	37,021	58,856	2,121	60,977	130,745	18,156	148,901

NOTES: "YEAR" IS BASED ON THE FINISHED DRILLING DATE OF THE WELL.
THIS LISTING CONTAINS DOUBLE COUNTING OF BOREHOLES BECAUSE A BOREHOLE IS DESIGNATED AS GAS, OIL OR OTHER IF AN EVENT OF THAT TYPE IS CONTAINED IN THE WELL. THUS, FOR MULTIPLE EVENT TYPE WELLS THE WELL WILL BE COUNTED IN MORE THAN ONE CATEGORY.

TABLE 3.4

FLOWING/PUMPING SPLIT OF OIL EVENTS

YEAR	SWEET FLOW	SWEET PUMP	SWEET OTHER	SWEET TOTAL	SOUR FLOW	SOUR PUMP	SOUR OTHER	SOUR TOTAL	TOTAL FLOW	TOTAL PUMP	TOTAL OTHER	TOTAL TOTAL
PRE1951	12	57	381	450	61	740	821	1,622	73	797	1,202	2,072
1951	19	73	178	270	14	175	361	550	33	248	539	820
1952	15	114	339	468	10	134	361	505	25	248	700	973
1953	18	147	275	440	16	158	178	352	34	305	453	792
1954	13	178	237	428	10	75	105	190	23	253	342	618
1955	13	399	265	677	24	58	74	156	37	457	339	833
1956	15	616	248	879	32	82	77	191	47	698	325	1,070
1957	13	403	164	580	24	60	85	169	37	463	249	749
1958	34	452	151	637	28	78	94	200	62	530	245	837
1959	37	451	157	645	12	25	48	85	49	476	205	730
1960	29	452	185	666	7	17	34	58	36	469	219	724
1961	51	378	195	624	7	22	41	70	58	400	236	694
1962	27	359	157	543	10	31	32	73	37	390	189	616
1963	41	405	187	633	8	81	97	186	49	486	284	819
1964	26	408	229	663	10	56	63	129	36	464	292	792
1965	35	433	247	715	14	36	47	97	49	469	294	812
1966	28	255	153	436	41	68	47	156	69	323	200	592
1967	24	210	126	360	50	164	148	362	74	374	274	722
1968	26	188	102	316	30	166	143	339	56	354	245	655
1969	21	155	96	272	16	74	113	203	37	229	209	475
1970	21	139	104	264	7	44	37	88	28	183	141	352
1971	23	162	98	283	16	49	43	108	39	211	141	391
1972	45	236	128	409	25	30	44	99	70	266	172	508
1973	44	311	175	530	9	26	38	73	53	337	213	603
1974	81	277	229	587	11	32	41	84	92	309	270	671
1975	60	415	202	677	8	14	27	49	68	429	229	726
1976	58	324	208	590	6	26	42	74	64	350	250	664
1977	57	355	300	712	17	46	44	107	74	401	344	819
1978	87	427	367	881	16	55	75	146	103	482	442	1,027
1979	128	502	424	1,054	57	83	109	249	185	585	533	1,303
1980	217	650	504	1,371	43	70	125	238	260	720	629	1,609
1981	182	538	398	1,118	28	63	126	217	210	601	524	1,335
1982	152	707	405	1,264	48	121	132	301	200	828	537	1,565
1983	204	878	455	1,537	75	172	178	425	279	1,050	633	1,962
1984	230	1,181	555	1,966	104	190	198	492	334	1,371	753	2,458
1985	295	1,358	553	2,206	113	249	205	567	408	1,607	758	2,773
1986	240	811	253	1,304	86	198	118	402	326	1,009	371	1,706
1987	320	1,046	266	1,632	125	242	111	478	445	1,288	377	2,110
1988	295	1,072	162	1,529	138	450	93	681	433	1,522	255	2,210
1989	240	421	28	689	115	248	29	392	355	669	57	1,081
1990	4	9	0	13	1	4	0	5	5	13	0	18
TOTAL	3,480	17,952	9,886	31,318	1,472	4,712	4,784	10,968	4,952	22,664	14,670	42,286

NOTES: "YEAR" IS BASED ON THE FINISHED DRILLING DATE OF THE WELL.

TABLE 3.5

FLOWING/PUMPING SPLIT OF OIL BOREHOLES

	SWEET				SOUR				TOTAL			
YEAR	FLOW	PUMP	OTHER	TOTAL	FLOW	PUMP	OTHER	TOTAL	FLOW	PUMP	OTHER	TOTAL
PRE1951	5	44	346	395	53	705	771	1,529	58	749	1,117	1,924
1951	13	59	138	210	13	152	338	503	26	211	476	713
1952	12	99	309	420	8	111	326	445	20	210	635	865
1953	12	129	236	377	15	142	169	326	27	271	405	703
1954	11	163	218	392	9	68	91	168	20	231	309	560
1955	11	388	251	650	18	53	58	129	29	441	309	779
1956	11	602	232	845	29	77	64	170	40	679	296	1,015
1957	10	380	146	536	19	48	76	143	29	428	222	679
1958	24	421	134	579	27	74	80	181	51	495	214	760
1959	30	420	132	582	11	23	46	80	41	443	178	662
1960	23	427	172	622	7	17	32	56	30	444	204	678
1961	39	355	165	559	5	19	36	60	44	374	201	619
1962	20	331	133	484	8	28	29	65	28	359	162	549
1963	32	354	153	539	8	69	83	160	40	423	236	699
1964	22	378	203	603	9	51	58	118	31	429	261	721
1965	32	396	231	659	9	30	35	74	41	426	266	733
1966	22	225	136	383	31	44	34	109	53	269	170	492
1967	17	198	105	320	27	79	85	191	44	277	190	511
1968	19	161	83	263	20	100	89	209	39	261	172	472
1969	13	144	87	244	9	49	70	128	22	193	157	372
1970	12	119	91	222	5	34	27	66	17	153	118	288
1971	16	145	86	247	8	30	26	64	24	175	112	311
1972	33	226	103	362	22	23	33	78	55	249	136	440
1973	29	293	155	477	9	22	35	66	38	315	190	543
1974	62	262	196	520	10	24	35	69	72	286	231	589
1975	50	399	180	629	6	12	25	43	56	411	205	672
1976	50	288	174	512	5	24	34	63	55	312	208	575
1977	46	308	238	592	14	43	41	98	60	351	279	690
1978	76	368	287	731	15	47	62	124	91	415	349	855
1979	98	439	329	866	41	76	89	206	139	515	418	1,072
1980	172	562	386	1,120	34	58	104	196	206	620	490	1,316
1981	142	463	303	908	22	55	99	176	164	518	402	1,084
1982	116	623	333	1,072	34	97	105	236	150	720	438	1,308
1983	166	778	374	1,318	53	145	143	341	219	923	517	1,659
1984	187	1,068	459	1,714	84	161	170	415	271	1,229	629	2,129
1985	267	1,237	469	1,973	91	219	177	487	358	1,456	646	2,460
1986	217	760	221	1,198	74	167	101	342	291	927	322	1,540
1987	273	984	239	1,496	115	222	93	430	388	1,206	332	1,926
1988	255	998	141	1,394	125	419	84	628	380	1,417	225	2,022
1989	215	405	27	647	111	232	28	371	326	637	55	1,018
1990	4	9	0	13	1	4	0	5	5	13	0	18
TOTAL	2,864	16,408	8,401	27,673	1,214	4,053	4,081	9,348	4,078	20,461	12,482	37,021

NOTES: "YEAR" IS BASED ON THE FINISHED DRILLING DATE OF THE WELL.
THIS IS THE SPLIT FOR THE "DOUBLE COUNTING" CASE DISCRIBED ON PAGE 3.

TABLE 3.6

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 1

POOL COUNTS PRODUCING POOLS IN ALBERTA (STATUS CODE 1 = OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962		245	245	36	37	8	12				93	338
1963		296	296	43	39	8	15				105	401
1964		341	341	46	39	10	16	1			112	453
1965		387	387	50	47	11	17	1			126	513
1966		403	403	50	62	12	19	1			144	547
1967		465	465	49	82	16	60	2		1	210	675
1968		534	534	52	99	48	69	5		1	274	808
1969		588	588	56	105	69	74	7		1	312	900
1970		604	604	53	104	75	78	6		1	317	921
1971		631	631	54	101	76	77	3		1	312	943
1972		631	631	54	102	78	81	4		1	320	951
1973		676	676	55	106	78	81	6		2	328	1,004
1974		708	708	62	102	76	81	6	1	2	330	1,038
1975		727	727	61	98	78	80	6	1	2	326	1,053
1976		777	777	63	99	74	81	6	1	2	326	1,103
1977		872	872	71	104	77	78	6	1	2	339	1,211
1978		969	969	81	113	79	78	6	1	2	360	1,329
1979		1,109	1,109	97	120	84	86	8		2	397	1,506
1980		1,268	1,268	105	132	82	88	8		2	417	1,685
1981		1,464	1,464	109	133	85	94	8	1	2	432	1,896
1982		1,660	1,660	116	149	92	95	6	1	1	460	2,120
1983		1,960	1,960	131	156	96	110	6	1	1	501	2,461
1984		2,284	2,284	149	165	110	108	9	1	1	543	2,827
1985		2,615	2,615	155	176	117	115	10	1		574	3,189
1986		2,716	2,716	165	182	121	120	5	1		594	3,310
1987		2,794	2,794	171	189	116	116	7	1		600	3,394
1988		3,099	3,099	179	190	121	114	7	1	1	613	3,712
1989		3,074	3,074	182	193	118	110	9	1	1	614	3,688

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.7

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 2

POOL COUNTS PRODUCING POOLS IN ALBERTA (STATUS CODE 2&3 = GAS/COND & GAS/OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962	5	163	168	52	15	3	8	3	3		84	252
1963	6	184	190	55	17	3	7	3	4		89	279
1964	6	246	252	61	17	7	8	5	5		103	355
1965	6	276	282	63	19	9	9	5	6		111	393
1966	6	290	296	55	25	8	12	6	6	1	113	409
1967	6	319	325	64	28	8	11	5	7	1	124	449
1968	6	367	373	69	34	10	14	7	6	1	141	514
1969	7	400	407	75	35	8	14	7	7	2	148	555
1970	7	430	437	75	31	13	13	7	8	1	148	585
1971	8	477	485	81	33	12	13	7	6	1	153	638
1972	10	547	557	81	31	12	10	5	7	1	147	704
1973	8	578	586	80	33	11	11	7	7	1	150	736
1974	14	650	664	88	37	13	14	6	8	1	167	831
1975	16	829	845	96	38	14	15	8	8	1	180	1,025
1976	20	1,191	1,211	122	42	14	18	9	8	1	214	1,425
1977	20	1,484	1,504	153	47	18	20	11	11	1	261	1,765
1978	20	1,714	1,734	195	52	20	20	12	10	1	310	2,044
1979	21	1,920	1,941	203	63	21	20	12	10	1	330	2,271
1980	21	2,135	2,156	214	59	26	21	12	9	1	342	2,498
1981	21	2,452	2,473	244	74	25	27	13	11	2	396	2,869
1982	22	2,827	2,849	274	63	25	30	12	11	1	416	3,265
1983	24	3,129	3,153	292	64	30	29	15	13	1	444	3,597
1984	25	3,294	3,319	311	67	32	40	15	13	1	479	3,798
1985	25	3,591	3,616	342	70	35	40	16	12	1	516	4,132
1986	25	3,767	3,792	348	67	38	45	19	11	1	529	4,321
1987	24	3,880	3,904	365	73	39	51	19	13	1	561	4,465
1988	25	4,068	4,093	371	86	40	51	20	13	1	582	4,675
1989	26	4,146	4,172	396	91	49	54	21	14	1	626	4,798

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.8

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 3

POOL COUNTS PRODUCING POOLS IN ALBERTA (STATUS: 1=OIL 2=GAS/COND 3=GAS/OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962	5	408	413	88	52	11	20	3	3		177	590
1963	6	480	486	98	56	11	22	3	4		194	680
1964	6	587	593	107	56	17	24	6	5		215	808
1965	6	663	669	113	66	20	26	6	6		237	906
1966	6	693	699	105	87	20	31	7	6	1	257	956
1967	6	784	790	113	110	24	71	7	7	2	334	1,124
1968	6	901	907	121	133	58	83	12	6	2	415	1,322
1969	7	988	995	131	140	77	88	14	7	3	460	1,455
1970	7	1,034	1,041	128	135	88	91	13	8	2	465	1,506
1971	8	1,108	1,116	135	134	88	90	10	6	2	465	1,581
1972	10	1,178	1,188	135	133	90	91	9	7	2	467	1,655
1973	8	1,254	1,262	135	139	89	92	13	7	3	478	1,740
1974	14	1,358	1,372	150	139	89	95	12	9	3	497	1,869
1975	16	1,556	1,572	157	136	92	95	14	9	3	506	2,078
1976	20	1,968	1,988	185	141	88	99	15	9	3	540	2,528
1977	20	2,356	2,376	224	151	95	98	17	12	3	600	2,976
1978	20	2,683	2,703	276	165	99	98	18	11	3	670	3,373
1979	21	3,029	3,050	300	183	105	106	20	10	3	727	3,777
1980	21	3,403	3,424	319	191	108	109	20	9	3	759	4,183
1981	21	3,916	3,937	353	207	110	121	21	12	4	828	4,765
1982	22	4,487	4,509	390	212	117	125	18	12	2	876	5,385
1983	24	5,089	5,113	423	220	126	139	21	14	2	945	6,058
1984	25	5,578	5,603	460	232	142	148	24	14	2	1,022	6,625
1985	25	6,206	6,231	497	246	152	155	26	13	1	1,090	7,321
1986	25	6,483	6,508	513	249	159	165	24	12	1	1,123	7,631
1987	24	6,674	6,698	536	262	155	167	26	14	1	1,161	7,859
1988	25	7,167	7,192	550	276	161	165	27	14	2	1,195	8,387
1989	26	7,220	7,246	578	284	167	164	30	15	2	1,240	8,486

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.9

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 4
WELL COUNTS PRODUCING POOLS IN ALBERTA (STATUS CODE 1 = OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962	1	4,943	4,944	944	2,308	266	178				3,696	8,640
1963	1	5,377	5,378	1,120	2,344	278	210				3,952	9,330
1964	1	5,715	5,716	1,128	2,351	285	232	2			3,998	9,714
1965		6,143	6,143	921	2,252	287	249	2			3,711	9,854
1966		6,352	6,352	735	1,509	256	281	2			2,783	9,135
1967		6,413	6,413	716	1,472	254	331	3		1	2,777	9,190
1968		6,572	6,572	651	1,468	281	357	6		1	2,764	9,336
1969		6,568	6,568	633	1,405	296	371	8		1	2,714	9,282
1970		6,678	6,678	738	1,416	275	374	7		1	2,811	9,489
1971	3	6,773	6,776	792	1,438	260	316	4		1	2,811	9,587
1972	11	6,906	6,917	930	1,506	276	321	5		1	3,039	9,956
1973	15	7,298	7,313	915	1,712	271	320	7		2	3,227	10,540
1974	24	7,665	7,689	941	1,740	273	299	7	1	2	3,263	10,952
1975	24	7,939	7,963	955	1,673	274	319	7	1	2	3,231	11,194
1976	76	8,372	8,448	940	1,647	271	309	7	1	2	3,177	11,625
1977	100	8,998	9,098	1,002	1,671	271	307	7	1	2	3,261	12,359
1978	162	9,497	9,659	1,045	1,718	279	316	7	1	2	3,368	13,027
1979	211	10,189	10,400	1,097	1,773	286	325	9		2	3,492	13,892
1980	238	10,926	11,164	1,164	1,850	279	334	9		2	3,638	14,802
1981	259	11,759	12,018	1,185	1,849	281	326	9	1	2	3,653	15,671
1982	261	12,479	12,740	1,221	1,885	295	346	7	1	1	3,756	16,496
1983	284	13,859	14,143	1,303	2,021	311	377	7	1	1	4,021	18,164
1984	282	15,454	15,736	1,377	2,116	325	415	11	1	1	4,246	19,982
1985	298	17,280	17,578	1,487	2,166	342	448	12	1		4,456	22,034
1986	269	18,730	18,999	1,558	2,169	366	468	6	1		4,568	23,567
1987	214	19,743	19,957	1,574	2,233	379	444	8	1		4,639	24,596
1988	155	21,238	21,393	1,641	2,301	405	447	8	1	1	4,804	26,197
1989	78	21,267	21,345	1,598	2,352	408	448	12	1	1	4,820	26,165

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.10

SWCP03F-2: 90-03-07 @ 16:06 — ENERGY RESOURCES CONSERVATION BOARD — PAGE: 5

WELL COUNTS — PRODUCING POOLS IN ALBERTA (STATUS CODE 2&3 = GAS/COND & GAS/OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962	246	651	897	170	90	12	36	19	20		347	1,244
1963	347	707	1,054	188	97	11	33	20	22		371	1,425
1964	391	809	1,200	181	111	22	36	24	24		398	1,598
1965	430	911	1,341	173	129	27	37	23	32		421	1,762
1966	458	969	1,427	160	152	26	43	28	47	3	459	1,886
1967	467	1,054	1,521	170	159	34	45	28	57	5	498	2,019
1968	568	1,189	1,757	182	157	45	78	30	91	8	591	2,348
1969	645	1,341	1,986	200	180	48	94	27	89	8	646	2,632
1970	784	1,409	2,193	213	181	58	131	28	92	7	710	2,903
1971	984	1,518	2,502	227	192	72	101	27	81	7	707	3,209
1972	1,358	1,674	3,032	237	193	79	122	28	80	6	745	3,777
1973	1,820	1,851	3,671	228	208	76	124	32	79	7	754	4,425
1974	2,364	2,038	4,402	237	217	79	137	29	87	5	791	5,193
1975	3,439	2,457	5,896	255	226	84	135	35	88	3	826	6,722
1976	5,419	3,344	8,763	303	239	94	140	40	92	4	912	9,675
1977	7,380	4,221	11,601	351	265	100	156	41	99	4	1,016	12,617
1978	8,835	4,869	13,704	405	279	108	156	45	104	4	1,101	14,805
1979	10,046	5,448	15,494	419	295	114	160	40	110	4	1,142	16,636
1980	11,807	6,046	17,853	437	307	122	154	41	113	4	1,178	19,031
1981	13,451	6,805	20,256	479	329	125	159	45	125	5	1,267	21,523
1982	15,154	7,530	22,684	550	309	127	166	40	126	4	1,322	24,006
1983	15,778	8,176	23,954	588	324	141	176	43	134	5	1,411	25,365
1984	16,586	8,619	25,205	605	375	152	199	42	135	4	1,512	26,717
1985	17,889	9,138	27,027	678	394	166	220	42	136	4	1,640	28,667
1986	18,629	9,660	28,289	710	387	171	227	50	148	4	1,697	29,986
1987	18,406	9,861	28,267	733	400	179	238	49	159	4	1,762	30,029
1988	18,862	10,366	29,228	754	434	186	239	56	158	1	1,828	31,056
1989	18,895	10,777	29,672	803	457	202	251	57	162	4	1,936	31,608

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.11

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 6

WELL COUNTS PRODUCING POOLS IN ALBERTA (STATUS: 1=OIL 2=GAS/COND 3=GAS/OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962	247	5,594	5,841	1,114	2,398	278	214	19	20		4,043	9,884
1963	348	6,084	6,432	1,308	2,441	289	243	20	22		4,323	10,755
1964	392	6,524	6,916	1,309	2,462	307	268	26	24		4,396	11,312
1965	430	7,054	7,484	1,094	2,381	314	286	25	32		4,132	11,616
1966	458	7,321	7,779	895	1,661	282	324	30	47	3	3,242	11,021
1967	467	7,467	7,934	886	1,631	288	376	31	57	6	3,275	11,209
1968	568	7,761	8,329	833	1,625	326	435	36	91	9	3,355	11,684
1969	645	7,909	8,554	833	1,585	344	465	35	89	9	3,360	11,914
1970	784	8,087	8,871	951	1,597	333	505	35	92	8	3,521	12,392
1971	987	8,291	9,278	1,019	1,630	332	417	31	81	8	3,518	12,796
1972	1,369	8,580	9,949	1,167	1,699	355	443	33	80	7	3,784	13,733
1973	1,835	9,149	10,984	1,143	1,920	347	444	39	79	9	3,981	14,965
1974	2,388	9,703	12,091	1,178	1,957	352	436	36	88	7	4,054	16,145
1975	3,463	10,396	13,859	1,210	1,899	358	454	42	89	5	4,057	17,916
1976	5,495	11,716	17,211	1,243	1,886	365	449	47	93	6	4,089	21,300
1977	7,480	13,219	20,699	1,353	1,936	371	463	48	100	6	4,277	24,976
1978	8,997	14,366	23,363	1,450	1,997	387	472	52	105	6	4,469	27,832
1979	10,257	15,637	25,894	1,516	2,068	400	485	49	110	6	4,634	30,528
1980	12,045	16,972	29,017	1,601	2,157	401	488	50	113	6	4,816	33,833
1981	13,710	18,564	32,274	1,664	2,178	406	485	54	126	7	4,920	37,194
1982	15,415	20,009	35,424	1,771	2,194	422	512	47	127	5	5,078	40,502
1983	16,062	22,035	38,097	1,891	2,345	452	553	50	135	6	5,432	43,529
1984	16,868	24,073	40,941	1,982	2,491	477	614	53	136	5	5,758	46,699
1985	18,187	26,418	44,605	2,165	2,560	508	668	54	137	4	6,096	50,701
1986	18,898	28,390	47,288	2,268	2,556	537	695	56	149	4	6,265	53,553
1987	18,620	29,604	48,224	2,307	2,633	558	682	57	160	4	6,401	54,625
1988	19,017	31,604	50,621	2,395	2,735	591	686	64	159	2	6,632	57,253
1989	18,973	32,044	51,017	2,401	2,809	610	699	69	163	5	6,756	57,773

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H_2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.12

PRODUCTION (E6M3) PRODUCING POOLS IN ALBERTA (STATUS CODE 1 = OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962	2	1,407	1,409	738	604	118	224				1,686	3,096
1963	1	1,600	1,602	721	582	124	228				1,657	3,259
1964		1,807	1,807	688	638	118	236	1			1,682	3,489
1965		1,983	1,983	704	576	113	494	2			1,891	3,875
1966		2,113	2,113	784	601	131	629				2,147	4,260
1967		2,355	2,355	882	702	142	619	1			2,347	4,703
1968		2,510	2,510	953	769	158	629	1		1	2,514	5,024
1969		2,812	2,812	1,069	887	208	779	5		3	2,953	5,766
1970		3,299	3,299	1,503	999	231	806	3			3,544	6,844
1971	1	3,600	3,601	1,724	1,064	234	918				3,943	7,544
1972	9	4,071	4,080	2,484	1,375	322	971	2		1	5,158	9,239
1973	23	4,902	4,926	3,204	1,662	358	978	19		2	6,226	11,153
1974	19	4,699	4,718	3,137	1,487	321	947	21		3	5,919	10,638
1975	16	4,522	4,538	3,121	1,245	318	954	41		1	5,683	10,221
1976	38	4,449	4,487	3,473	1,205	296	827	38		1	5,843	10,331
1977	128	4,610	4,738	3,541	1,193	309	750	53		1	5,849	10,588
1978	149	4,802	4,951	3,614	1,226	311	743	57		1	5,954	10,905
1979	155	5,299	5,455	4,091	1,607	326	719	53		1	6,801	12,256
1980	181	5,369	5,551	4,233	1,617	319	681	56			6,909	12,460
1981	159	5,854	6,013	4,223	1,493	326	641	66			6,752	12,765
1982	144	6,077	6,221	4,168	1,518	360	557	56			6,662	12,883
1983	143	6,228	6,371	4,214	1,639	364	533	54	2		6,808	13,180
1984	143	6,908	7,051	4,569	1,948	421	538	61	2		7,541	14,593
1985	111	7,315	7,426	4,656	2,061	479	535	46	1		7,780	15,207
1986	123	7,925	8,048	4,246	2,013	474	619	15	1		7,370	15,418
1987	95	8,955	9,051	4,028	2,293	507	621	16			7,468	16,519
1988	62	10,033	10,095	4,215	2,462	573	542	19		1	7,816	17,912
1989	21	10,465	10,487	4,051	2,556	612	540	24			7,786	18,273

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.13

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 8
PRODUCTION (E6M3) PRODUCING POOLS IN ALBERTA (STATUS CODE 2&3 = GAS/COND & GAS/OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962	816	5,872	6,689	3,480	4,726	602	2,059	1,329	671		12,870	19,559
1963	974	7,575	8,550	3,924	5,120	703	2,292	2,639	851		15,532	24,082
1964	1,202	9,407	10,609	4,897	5,999	781	1,961	2,962	1,284		17,886	28,496
1965	1,457	10,551	12,008	5,551	6,453	1,150	1,806	2,869	1,336		19,168	31,177
1966	1,491	10,504	11,995	5,547	7,654	1,156	1,799	2,766	1,721	42	20,688	32,683
1967	1,588	11,070	12,659	5,875	8,530	1,359	1,984	2,625	2,404	303	23,083	35,742
1968	1,793	12,273	14,067	6,425	9,155	1,866	2,859	2,128	3,556	355	26,347	40,415
1969	1,939	14,708	16,648	6,795	10,578	2,131	4,201	2,189	3,658	327	29,883	46,531
1970	2,242	17,427	19,670	7,482	11,673	2,758	6,178	2,444	3,277	331	34,146	53,817
1971	2,310	18,586	20,896	7,728	12,079	5,804	6,809	1,903	3,066	228	37,620	58,517
1972	2,519	19,071	21,591	8,289	12,098	7,400	11,699	2,062	4,525	198	46,274	67,866
1973	2,835	21,266	24,102	8,925	12,242	7,065	12,347	1,748	5,550	127	48,005	72,108
1974	3,386	22,091	25,477	9,098	12,833	7,034	12,252	1,244	5,483	133	48,081	73,559
1975	4,166	22,683	26,849	9,117	12,553	6,839	12,129	1,585	5,221	121	47,568	74,418
1976	5,428	24,477	29,905	9,281	11,041	6,508	11,141	2,080	5,343	113	45,511	75,417
1977	6,612	26,359	32,972	9,654	10,715	6,158	12,048	2,036	5,324	108	46,046	79,018
1978	6,951	27,487	34,438	8,976	9,250	5,777	11,391	1,933	5,746	125	43,202	77,640
1979	7,512	29,543	37,055	9,480	9,919	5,796	11,567	2,219	4,923	121	44,028	81,084
1980	8,117	28,358	36,475	8,600	8,277	5,320	10,467	2,014	5,447	108	40,235	76,710
1981	7,867	30,214	38,082	7,889	7,348	5,369	10,389	1,865	5,006	96	37,964	76,047
1982	7,979	32,915	40,895	8,145	7,006	5,092	10,033	1,889	4,648	78	36,894	77,790
1983	7,446	30,905	38,351	7,076	6,562	5,134	9,860	2,035	5,073	90	35,833	74,185
1984	8,219	33,871	42,091	7,453	6,528	5,755	9,594	2,036	4,891	74	36,333	78,424
1985	8,290	37,757	46,048	8,447	6,762	5,968	10,474	1,970	4,606	42	38,271	84,320
1986	7,779	35,883	43,663	8,712	5,943	5,762	10,481	1,947	4,168	62	37,078	80,741
1987	7,260	39,579	46,840	10,159	6,467	6,071	9,766	2,313	4,381	26	39,186	86,026
1988	8,483	48,087	56,571	11,290	6,560	7,506	9,901	2,066	4,319		41,645	98,217
1989	8,040	50,673	58,714	11,887	6,070	7,672	9,435	1,883	3,854	51	40,856	99,570

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.14

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 9
PRODUCTION (E6M3) PRODUCING POOLS IN ALBERTA (STATUS: 1=OIL 2=GAS/COND 3=GAS/OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962	818	7,280	8,098	4,219	5,331	721	2,284	1,329	671		14,556	22,655
1963	976	9,175	10,152	4,646	5,702	828	2,521	2,639	851		17,189	27,342
1964	1,202	11,214	12,417	5,585	6,637	899	2,197	2,963	1,284		19,568	31,985
1965	1,457	12,535	13,992	6,256	7,030	1,263	2,301	2,871	1,336		21,060	35,052
1966	1,491	12,617	14,108	6,331	8,255	1,288	2,429	2,767	1,721	42	22,835	36,944
1967	1,588	13,426	15,014	6,757	9,233	1,502	2,603	2,626	2,404	303	25,431	40,446
1968	1,793	14,784	16,577	7,378	9,925	2,025	3,488	2,130	3,556	357	28,862	45,440
1969	1,939	17,520	19,460	7,865	11,466	2,339	4,981	2,194	3,658	330	32,837	52,297
1970	2,242	20,726	22,969	8,986	12,673	2,989	6,985	2,447	3,277	332	37,691	60,661
1971	2,311	22,186	24,498	9,452	13,143	6,039	7,728	1,903	3,066	229	41,564	66,062
1972	2,528	23,143	25,672	10,773	13,474	7,722	12,671	2,065	4,525	199	51,432	77,105
1973	2,859	26,169	29,029	12,129	13,904	7,423	13,325	1,767	5,550	130	54,232	83,261
1974	3,405	26,790	30,196	12,236	14,321	7,356	13,200	1,265	5,483	136	54,001	84,198
1975	4,182	27,205	31,388	12,238	13,799	7,157	13,084	1,626	5,221	122	53,252	84,640
1976	5,466	28,926	34,393	12,755	12,247	6,805	11,969	2,118	5,343	115	51,354	85,748
1977	6,740	30,970	37,710	13,195	11,908	6,467	12,798	2,090	5,324	109	51,895	89,606
1978	7,100	32,289	39,389	12,590	10,476	6,088	12,135	1,990	5,747	126	49,156	88,546
1979	7,668	34,842	42,510	13,572	11,526	6,123	12,287	2,273	4,923	123	50,829	93,340
1980	8,298	33,727	42,026	12,833	9,895	5,640	11,148	2,070	5,447	108	47,145	89,171
1981	8,026	36,069	44,096	12,113	8,841	5,696	11,030	1,932	5,006	96	44,716	88,812
1982	8,123	38,993	47,116	12,313	8,524	5,453	10,591	1,945	4,648	78	43,557	90,673
1983	7,589	37,133	44,723	11,291	8,201	5,499	10,394	2,090	5,075	90	42,642	87,366
1984	8,362	40,780	49,143	12,022	8,476	6,177	10,132	2,097	4,893	74	43,874	93,017
1985	8,402	45,073	53,475	13,103	8,824	6,447	11,010	2,016	4,607	42	46,051	99,527
1986	7,902	43,808	51,711	12,958	7,957	6,236	11,101	1,963	4,169	62	44,449	96,160
1987	7,356	48,534	55,891	14,187	8,760	6,579	10,388	2,329	4,381	26	46,654	102,546
1988	8,546	58,121	66,667	15,506	9,022	8,080	10,444	2,086	4,320	1	49,462	116,130
1989	8,062	61,138	69,201	15,939	8,627	8,284	9,976	1,907	3,854	51	48,643	117,844

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.

TABLE 3.15

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 10
SULPHUR (TONNES) PRODUCING POOLS IN ALBERTA (STATUS CODE 1 = OIL WELLS)

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962				2,808	27,048	11,108	53,784				94,750	94,750
1963				2,796	25,984	11,674	54,163				94,619	94,619
1964				2,548	27,853	11,054	55,466	578			97,501	97,501
1965				2,499	24,525	10,890	105,015	817			143,749	143,749
1966				2,907	25,645	12,760	132,425	324			174,061	174,061
1967				3,301	28,158	13,898	131,198	394		39	176,991	176,991
1968				3,527	31,408	15,433	132,586	646		1,102	184,704	184,704
1969				4,025	39,006	20,152	162,472	1,720		2,008	229,385	229,385
1970				5,616	43,917	22,469	169,025	921		409	242,359	242,359
1971				6,478	46,990	22,780	190,662	219		594	267,725	267,725
1972				9,524	58,853	30,968	205,114	862		757	306,080	306,080
1973				12,467	68,650	35,354	210,643	5,666		1,899	334,682	334,682
1974				12,104	62,279	31,911	206,314	6,180	25	2,081	320,897	320,897
1975				11,341	53,050	31,074	207,080	12,016	15	850	315,429	315,429
1976				12,994	51,794	28,841	177,684	11,071	203	1,058	283,647	283,647
1977				13,543	50,452	29,884	162,850	15,349	162	766	273,009	273,009
1978				13,669	51,506	29,718	161,670	16,645	349	680	274,241	274,241
1979				15,716	64,848	31,277	160,663	15,515		1,009	289,029	289,029
1980				16,537	67,521	30,294	152,505	16,334		364	283,556	283,556
1981				17,039	63,101	30,174	142,892	19,218	1	42	272,471	272,471
1982				16,500	64,952	32,917	121,917	16,107	330	61	252,788	252,788
1983				17,326	69,276	33,378	113,230	15,619	1,203	11	250,046	250,046
1984				18,863	79,903	38,240	113,340	17,837	1,140	138	269,464	269,464
1985				19,394	86,314	43,673	110,710	13,230	786		274,110	274,110
1986				17,208	86,334	42,930	125,323	4,449	513		276,761	276,761
1987				15,665	96,783	45,929	124,745	4,672	414		288,210	288,210
1988				17,659	100,960	52,276	107,842	5,620	252	782	285,394	285,394
1989				17,859	98,627	55,681	108,476	6,965	79	160	287,849	287,849

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.
4) SULPHUR PRODUCTION IS A BALLPARK ESTIMATE CALCULATED AS PRODUCTION TIMES POOL AVERAGE PERCENTH2S.

TABLE 3.16

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD

SULPHUR (TONNES) PRODUCING POOLS IN ALBERTA (STATUS CODE 2&3 = GAS/COND & GAS/OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962				16,519	157,955	54,333	357,120	414,643	303,727		1,304,301	1,304,301
1963				19,556	175,156	63,496	415,563	856,939	381,627		1,912,339	1,912,339
1964				22,731	200,304	71,663	365,940	977,953	566,100		2,204,693	2,204,693
1965				24,772	215,198	112,064	349,678	927,807	591,006		2,220,528	2,220,528
1966				25,609	252,779	113,323	359,614	884,556	760,141	29,781	2,425,807	2,425,807
1967				28,154	293,424	138,724	411,464	811,037	1,060,101	214,094	2,957,002	2,957,002
1968				31,517	302,999	179,216	623,739	636,336	1,579,830	250,568	3,604,206	3,604,206
1969				32,503	342,436	210,575	947,782	635,130	1,628,807	231,884	4,029,120	4,029,120
1970				34,609	370,248	266,354	1,406,153	717,317	1,467,128	233,675	4,495,488	4,495,488
1971				36,297	378,649	638,597	1,548,715	556,707	1,375,845	161,160	4,695,974	4,695,974
1972				39,263	377,952	834,700	2,691,760	602,576	2,032,680	139,697	6,718,632	6,718,632
1973				43,156	384,407	798,735	2,835,767	515,596	2,493,202	90,147	7,161,012	7,161,012
1974				41,643	394,224	800,800	2,816,110	372,897	2,460,378	93,947	6,980,002	6,980,002
1975				41,627	381,421	770,366	2,791,491	487,418	2,346,400	85,614	6,904,339	6,904,339
1976				42,807	333,962	726,105	2,561,313	669,419	2,400,670	80,319	6,814,598	6,814,598
1977				44,234	325,180	688,905	2,754,779	650,211	2,387,974	76,583	6,927,870	6,927,870
1978				40,424	280,815	646,483	2,582,029	616,023	2,573,318	88,762	6,827,857	6,827,857
1979				41,810	296,457	639,746	2,634,330	697,804	2,204,191	85,892	6,600,231	6,600,231
1980				37,496	255,575	573,858	2,393,584	624,386	2,439,635	76,208	6,400,746	6,400,746
1981				33,341	222,022	576,566	2,352,799	573,059	2,239,999	68,117	6,065,906	6,065,906
1982				35,628	214,784	547,093	2,260,873	573,959	2,077,920	55,461	5,765,722	5,765,722
1983				31,581	205,389	551,667	2,217,515	625,981	2,269,051	63,651	5,964,837	5,964,837
1984				30,629	203,124	623,619	2,156,947	629,933	2,180,554	52,381	5,877,190	5,877,190
1985				35,265	208,631	653,509	2,361,935	609,534	2,054,113	29,633	5,952,623	5,952,623
1986				37,470	185,409	624,686	2,319,215	601,716	1,861,328	43,967	5,673,794	5,673,794
1987				45,975	212,689	657,085	2,175,712	710,090	1,956,842	18,976	5,777,373	5,777,373
1988				50,445	219,197	829,334	2,147,436	644,596	1,925,765	311	5,817,088	5,817,088
1989				53,128	207,309	838,787	2,039,263	606,384	1,719,596	28,351	5,492,820	5,492,820

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.
4) SULPHUR PRODUCTION IS A BALLPARK ESTIMATE CALCULATED AS PRODUCTION TIMES POOL AVERAGE PERCENTH2S.

TABLE 3.17

SWCP03F-2: 90-03-07 @ 16:06 ENERGY RESOURCES CONSERVATION BOARD PAGE: 12

SULPHUR (TONNES) PRODUCING POOLS IN ALBERTA (STATUS: 1=OIL 2=GAS/COND 3=GAS/OIL WELLS)

----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+---10----+---11----+---12----+---13-

YEAR	S.E.ALTA	OTH SWEET	TOT SWEET	0- 1%H2S	1- 5%H2S	5-10%H2S	10-20%H2S	20-30%H2S	30-40%H2S	>40%H2S	TOTL SOUR	GRND TOT
1962				19,328	185,004	65,442	410,904	414,643	303,727		1,399,051	1,399,051
1963				22,353	201,140	75,170	469,727	856,939	381,627		2,006,959	2,006,959
1964				25,279	228,158	82,718	421,406	978,531	566,100		2,302,194	2,302,194
1965				27,272	239,724	122,954	454,693	928,624	591,006		2,364,277	2,364,277
1966				28,516	278,425	126,083	492,040	884,880	760,141	29,781	2,599,868	2,599,868
1967				31,456	321,583	152,623	542,662	811,432	1,060,101	214,134	3,133,993	3,133,993
1968				35,044	334,408	194,650	756,325	636,982	1,579,830	251,670	3,788,911	3,788,911
1969				36,529	381,443	230,727	1,110,254	636,850	1,628,807	233,892	4,258,506	4,258,506
1970				40,226	414,165	288,823	1,575,179	718,238	1,467,128	234,085	4,737,847	4,737,847
1971				42,776	425,640	661,378	1,739,378	556,926	1,375,845	161,754	4,963,699	4,963,699
1972				48,787	436,805	865,668	2,896,875	603,438	2,032,680	140,455	7,024,712	7,024,712
1973				55,624	453,057	834,089	3,046,411	521,262	2,493,202	92,047	7,495,695	7,495,695
1974				53,748	456,504	832,711	3,022,424	379,077	2,460,404	96,028	7,300,899	7,300,899
1975				52,969	434,472	801,440	2,998,571	499,435	2,346,415	86,464	7,219,768	7,219,768
1976				55,802	385,756	754,946	2,738,997	680,491	2,400,873	81,377	7,098,245	7,098,245
1977				57,778	375,633	718,790	2,917,630	665,560	2,388,137	77,350	7,200,880	7,200,880
1978				54,094	332,322	676,202	2,743,700	632,669	2,573,667	89,442	7,102,099	7,102,099
1979				57,526	361,305	671,023	2,794,994	713,320	2,204,191	86,901	6,889,261	6,889,261
1980				54,033	323,096	604,152	2,546,090	640,720	2,439,635	76,573	6,684,302	6,684,302
1981				50,381	285,123	606,741	2,495,692	592,277	2,240,000	68,160	6,338,378	6,338,378
1982				52,129	279,737	580,011	2,382,791	590,066	2,078,251	55,522	6,018,510	6,018,510
1983				48,907	274,665	585,046	2,330,745	641,600	2,270,255	63,663	6,214,883	6,214,883
1984				49,493	283,028	661,859	2,270,287	647,771	2,181,694	52,519	6,146,655	6,146,655
1985				54,660	294,946	697,183	2,472,645	622,764	2,054,900	29,633	6,226,734	6,226,734
1986				54,679	271,744	667,617	2,444,539	606,165	1,861,842	43,967	5,950,556	5,950,556
1987				61,640	309,473	703,015	2,300,458	714,762	1,957,257	18,976	6,065,583	6,065,583
1988				68,105	320,158	881,611	2,255,279	650,216	1,926,018	1,093	6,102,482	6,102,482
1989				70,987	305,936	894,469	2,147,739	613,349	1,719,675	28,511	5,780,670	5,780,670

NOTE: 1) THIS SUMMARY IS BASED ON THE ERCB PRODUCTION HISTORY DATA FOR GAS WELLS.
2) A WELL IS COUNTED AS SOUR IF THE GRS OR GEDS POOL AVERAGE GAS ANALYSIS INDICATES H2S >= 0.01%.
3) MULTI-ZONE WELLS WILL BE COUNTED ONCE FOR EACH ZONE.
4) SULPHUR PRODUCTION IS A BALLPARK ESTIMATE CALCULATED AS PRODUCTION TIMES POOL AVERAGE PERCENTH2S.

Table 3.18

Status Codes for Basic Well Data File

CODE	FLUID F	MODE M	TYPE T	STRUCTURE S
0	NO FLUID			
1	CRUDE OIL	SUSPENDED	REPRODUCER	
2	GAS	ABANDONED	STORAGE	DUAL ZONE
3	OIL	ABANDONED ZONE	INJECTION	TRIPLE ZONE
4	GAS-WATER	ABANDONED & REENTERED	DISPOSAL	FOUR ZONE
5	UNDESIGNATED	CAPPED	OBSERVATION	
6	WATER	POTENTIAL	TRAINING	
7	BRINE	STANDING	EXPERIMENTAL	
8	WASTE	JUNKED & ABANDONED	FARM	
9	SOLVENT	CLOSED	INDUSTRIAL	
10	STEAM	FLOWING	CYCLICAL	
11	AIR	PUMPING	SOURCE	
12	SYNTHETIC CRUDE	GAS LIFT		
13	CARBON DIOXIDE	TESTING		
14	POLYMER	ABANDONED & WHIPSTOCKED		
15	NITROGEN			
16	LIQUID PETROLEUM GAS			
17	CRUDE BITUMEN			

Note: There are cases in the following list where 0's appear. These 0's only mean that that particular parameter (F, M, T, S) is not required to define the well status. The case of 0,0,0,0 is beleived to represent those wells which were licensed but never drilled.

Table 3.19 STATUS SUMMARY - EVENT BASIS

FLUID	MODE	TYPE	STRUCTURE		SWEET	SOUR	TOTAL
0-	0-	0-	0-	=	1718	6	1724
0-	0-	0-	5-commingled	=	513	28	541
0-	0-	5-observation	0-	=	180	18	198
0	0-	5-observation	2-dual zone	=	4	0	4
0-	0-	6-training	0-	=	14	0	14
0-	0-	10-cyclical	0-	=	2222	2	2224
0-	0-	10-cyclical	2-dual zone	=	1	0	1
			mode subtotal	=	**4652**	**54**	**4706**
0-	1-suspended	5-observation	0-	=	33	0	33
0-	1-suspended	10-cyclical	0-	=	621	1	622
0-	1-suspended	10-cyclical	2-dual zone	=	13	0	13
			mode subtotal	=	**667**	**1**	**668**
0-	2-abandoned	0-	0-	=	45915	1308	47223
0-	2-abandoned	5-cyclical	0-	=	20	1	21
0-	2-abandoned	10-cyclical	0-	=	136	0	136
			mode subtotal	=	**46071**	**1309**	**47380**
0-	3-abandoned zone	0-	0-	=	1211	326	1537
0-	3-abandoned zone	5-observation	0-	=	4	0	4
0-	3-abandoned zone	10-cyclical	0-	=	8	0	8
			mode subtotal		**1223**	**326**	**1549**
0-	4-aband & reentered	0-	0-	=	348	69	417
			mode subtotal	=	**348**	**69**	**417**
0-	6-potential	5-observation	0-	=	18	0	18
0-	6-potential	5-observation	2-dual zone	=	3	0	3
			mode subtotal	=	**21**	**0**	**21**
0-	7-standing	0-	0-	=	1609	133	1742
0-	7-standing	0-	2-dual zone	=	112	19	131
0-	7-standing	0-	3-triple zone	=	10	3	13
0-	7-standing	0-	4-four zone	=	2	0	2
			mode subtotal	=	**1733**	**155**	**1888**
0-	8-junked & abandoned	0-	0-	=	82	2	84
			mode subtotal	=	**82**	**2**	**84**
0-	9-closed	0-	0-	=	1	0	1
			mode subtotal	=	**1**	**0**	**1**

0-	14-abandoned & whipstock	0-	0-	=	335	73	408
			mode subtotal	=	**335**	**73**	**408**
			fluid subtotal	=	**55133**	**1989**	**57122**
1-crude oil	1-suspended	0-	0	=	4398	1785	6183
1-crude oil	1-suspended	0-	2-dual zone	=	526	219	745
1-crude oil	1-suspended	0-	3-triple zone	=	24	10	34
1-crude oil	1-suspended	0-	4-four zone	=	0	1	1
			mode subtotal	=	**4948**	**2015**	**6963**
1-crude oil	2-abandoned	0-	0-	=	2418	1422	3840
			mode subtotal	=	**2418**	**1422**	**3840**
1-crude oil	3-abandoned	0-	0-	=	1264	666	1930
			mode subtotal	=	**1264**	**666**	**1930**
1-crude oil	4-abandoned & reentered	0-	0-	=	187	67	254
			mode subtotal	=	**187**	**67**	**254**
1-crude oil	10-flowing	0-	0-	=	2670	1163	3833
1-crude oil	10-flowing	0-	2-dual zone	=	354	131	485
1-crude oil	10-flowing	0-	3-triple zone	=	35	6	41
1-crude oil	10-flowing	0-	4-four zone	=	11	0	11
			mode subtotal	=	**3070**	**1300**	**4370**
1-crude oil	11-pumping	0-	0-	=	16257	4002	20259
1-crude oil	11-pumping	0-	2-dual zone	=	614	237	851
1-crude oil	11-pumping	0-	3-triple zone	=	17	0	17
			mode subtotal	=	**16888**	**4239**	**21127**
1-crude oil	12-gas lift	0-	0-	=	157	93	250
1-crude oil	12-gas lift	0-	2-dual zone	=	0	1	1
			mode subtotal	=	**157**	**94**	**251**
1-crude oil	14-abandoned & whipstock	0-	0-	=	10	15	25
			mode subtotal	=	**10**	**15**	**25**
			fluid subtotal	=	**28942**	**9818**	**38760**
2-gas	0-	2-storage	0-	=	32	6	38
2-gas	0-	2-storage	2-dual zone	=	0	3	3
2-gas	0-	3-injection	0-	=	43	96	139
2-gas	0-	3-injection	2-dual zone	=	4	18	22
2-gas	0-	8-farm	0-	=	77	9	86

			mode subtotal	=	**156**	**132**	**288**
2-gas	1-suspended	0-	0-	=	1720	295	2015
2-gas	1-suspended	0-	2-dual zone	=	1277	159	1436
2-gas	1-suspended	0-	3-triple zone	=	123	13	136
2-gas	1-suspended	0-	4-four zone	=	2	2	4
2-gas	1-suspended	3-injection	0-	=	3	8	11
2-gas	1-suspended	3-injection	2-dual zone	=	7	10	17
2-gas	1-suspended	3-injection	3-triple zone	=	1	0	1
			mode subtotal	=	**3133**	**487**	**3620**
2-gas	2-abandoned	0-	0-	=	1025	198	1223
2-gas	2-abandoned	2-storage	0-	=	1	1	2
2-gas	2-abandoned	3-injection	0-	=	3	3	6
2-gas	2-abandoned	8-farm	0-	=	16	2	18
			mode subtotal	=	**1045**	**204**	**1249**
2-gas	3-abandoned zone	0-	0-	=	1355	206	1561
2-gas	3-abandoned zone	2-storage	0-	=	1	0	1
2-gas	3-abandoned zone	3-injection	0-	=	1	9	10
2-gas	3-abandoned zone	8-farm	0-	=	2	0	2
			mode subtotal		**1359**	**215**	**1574**
2-gas	4-abandoned & reentered	0-	0-	=	16	9	25
			mode subtotal	=	**16**	**9**	**25**
2-gas	5-capped	0-	0-	=	7571	1604	9175
2-gas	5-capped	0-	2-dual zone	=	1950	373	2323
2-gas	5-capped	0-	3-triple zone	=	159	27	186
2-gas	5-capped	0-	4-four zone	=	6	6	12
			mode subtotal	=	**9686**	**2010**	**11696**
2-gas	10-flowing	0-	0-	=	19216	1660	20876
2-gas	10-flowing	0-	2-dual zone	=	10703	325	11028
2-gas	10-flowing	0-	3-triple zone	=	205	14	219
2-gas	10-flowing	0-	4-four zone	=	7	1	8
			mode subtotal	=	**30131**	**2000**	**32131**
2-gas	14-abandoned & whipstock	0-	0-	=	0	3	3
			mode subtotal	=	**0**	**3**	**3**
			fluid subtotal	=	**45526**	**5060**	**50586**
5-undesignated	1-suspended	0-	0-	=	3168	614	3782
5-undesignated	1-suspended	0-	2-dual zone	=	464	131	595
5-undesignated	1-suspended	0-	3-triple zone	=	44	8	52

5-undesignated	1-suspended	0-	4-four zone	=	3	0	3
			mode subtotal	=	**3679**	**753**	**4432**
			fluid subtotal	=	**3679**	**753**	**4432**
6-water	0-	3-injection	0-	=	3485	441	3926
6-water	0-	3-injection	2-dual zone	=	47	40	87
6-water	0-	4-disposal	0-	=	501	291	792
6-water	0-	4-disposal	2-dual zone	=	17	12	29
6-water	0-	4-disposal	3-triple zone	=	1	0	1
6-water	0-	8-farm	0-	=	170	242	412
6-water	0-	11-source	0-	=	380	31	411
6-water	0-	11-source	2-dual zone	=	4	0	4
			mode subtotal	=	**4605**	**1057**	**5662**
6-water	1-suspended	3-injection	0-	=	370	43	413
6-water	1-suspended	3-injection	2-dual zone	=	5	13	18
6-water	1-suspended	4-disposal	0-	=	72	32	104
6-water	1-suspended	4-disposal	2-dual zone	=	8	5	13
6-water	1-suspended	11-source	0-	=	292	37	329
			mode subtotal	=	**747**	**130**	**877**
6-water	2-abandoned	3-injection	0-	=	387	48	435
6-water	2-abandoned	4-disposal	0-	=	85	51	136
6-water	2-abandoned	8-farm	0-	=	1	0	1
6-water	2-abandoned	11-source	0-	=	67	17	84
			mode subtotal	=	**540**	**116**	**656**
6-water	3-abandoned zone	3-injection	0-	=	30	16	46
6-water	3-abandoned zone	4-disposal	0-	=	34	20	54
6-water	3-abandoned zone	11-source	0-	=	9	1	10
			mode subtotal	=	**73**	**37**	**110**
6-water	4-abandoned & reentered	3-injection	0-	=	8	3	11
6-water	4-abandoned & reentered	4-disposal	0-	=	2	0	2
			mode subtotal	=	**10**	**3**	**13**
6-water	6-potential	3-injection	0-	=	35	4	39
6-water	6-potential	3-injection	2-dual zone	=	0	1	1
6-water	6-potential	4-disposal	0-	=	47	14	61
6-water	6-potential	4-disposal	2-dual zone	=	6	2	8
6-water	6-potential	11-source	0-	=	161	4	165
			mode subtotal	=	**249**	**25**	**274**
6-water	14-abandoned & whipstock	3-injection	0-	=	2	0	2

			mode subtotal	=	**2**	**0**	**2**
			fluid subtotal	=	**6226**	**1368**	**7594**
7-brine	0-	0-	0-	=	25	2	27
			mode subtotal	=	**25**	**2**	**27**
7-brine	1-suspended	0-	0-	=	7	0	7
			mode subtotal	=	**7**	**0**	**7**
7-brine	2-abandoned	0-	0-	=	8	1	9
			mode subtotal	=	**8**	**1**	**9**
7-brine	3-abandoned zone	0-	0-	=	2	0	2
			mode subtotal	=	**2**	**0**	**2**
7-brine	10-flowing	0-	0-	=	0	2	2
			mode subtotal	=	**0**	**2**	**2**
			fluid subtotal	=	**42**	**5**	**47**
8-waste	0-	9-industrial	0-	=	3	7	10
			mode subtotal	=	**3**	**7**	**10**
8-waste	1-suspended	9-industrial	0-	=	2	1	3
			mode subtotal	=	**2**	**1**	**3**
8-waste	2-abandoned	9-industrial	0-		5	1	6
			mode subtotal	=	**5**	**1**	**6**
			fluid subtotal	=	**10**	**9**	**19**
9-solvent	0-	3-injection	0-	=	256	61	317
9-solvent	0-	3-injection	2-dual zone	=	1	5	6
			mode subtotal	=	**257**	**66**	**323**
9-solvent	1-suspended	3-injection	0-	=	2	0	2
			mode subtotal	=	**2**	**0**	**2**
9-solvent	3-abandoned zone	3-injection	0-	=	1	0	1
			mode subtotal	=	**1**	**0**	**1**
			fluid subtotal	=	**260**	**66**	**326**
10-steam	0-	3-injection	0-	=	67	0	67
			mode subtotal	=	**67**	**0**	**67**
10-steam	1-suspended	3-injection	0-	=	43	0	43
10-steam	1-suspended	3-injection	2-dual zone	=	1	0	1

			mode subtotal	=	**44**	**0**	**44**
10-steam	2-abandoned	3-injection	0-	=	30	0	30
			mode subtotal	=	**30**	**0**	**30**
			fluid subtotal	=	**141**	**0**	**141**
11-air	0-	3-injection	0-	=	12	0	12
			mode subtotal	=	**12**	**0**	**12**
11-air	1-suspended	3-injection	0-	=	16	0	16
			mode subtotal	=	**16**	**0**	**16**
11-air	2-abandoned	3-injection	0-	=	23	0	23
			mode subtotal	=	**23**	**0**	**23**
			fluid subtotal	=	**51**	**0**	**51**
13-carbon dioxide	0-	3-injection	0-	=	1	1	2
			mode subtotal	=	**1**	**1**	**2**
			fluid subtotal	=	**1**	**1**	**2**
16-lpg	0-	2-storage	0-	=	41	12	53
16-lpg	0-	3-injection	0-	=	0	3	3
			mode subtotal	=	**41**	**15**	**56**
16-lpg	1-suspended	2-storage	0-	=	3	0	3
16-lpg	1-suspended	3-injection	0-	=	1	2	3
			mode subtotal	=	**4**	**2**	**6**
16-lpg	2-abandoned	3-injection	0-	=	0	2	2
			mode subtotal	=	**0**	**2**	**2**
16-lpg	3-abandoned zone	2-storage	0-	=	1	0	1
16-lpg	3-abandoned zone	3-injection	0-	=	1	0	1
			mode subtotal	=	**2**	**0**	**2**
			fluid subtotal	=	**47**	**19**	**66**
17-crude bitumen	1-suspended	0-	0-	=	340	2	342
17-crude bitumen	1-suspended	0-	2-dual zone	=	15	1	16
			mode subtotal	=	**355**	**3**	**358**
17-crude bitumen	2-abandoned	0-	0-	=	147	2	149
			mode subtotal	=	**147**	**2**	**149**
17-crude bitumen	3-abandoned zone	0-	0-	=	161	1	162
			mode subtotal	=	**161**	**1**	**162**

17-crude bitumen	4-abandoned & reentered	0-	0-	=	5	0	5
			mode subtotal	=	**5**	**0**	**5**
			0-	=	1132	8	1140
17-crude bitumen	11-pumping	0-	2-dual zone	=	8	0	8
17-crude bitumen	11-pumping	0-	**mode subtotal**	=	**1140**	**8**	**1148**
			fluid subtotal	=	**1808**	**14**	**1822**
			grand total	=	**141866**	**19102**	**160968**

Summary of Generated Events

Code	Sweet	Sour	Total
6	5899	1667	7566
7	0	0	0
17	996	2450	3446
18	0	0	0
19	0	0	0
27	816	1744	2560
28	0	0	0
29	0	0	0
Grand Total	7711	5861	13572

Table 3.20

Historical Drilling Statistics
Sweet - Oil Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	301	96	3	0	0	400
1951	79	118	2	0	0	199
1952	204	216	2	0	0	422
1953	122	240	6	1	0	369
1954	69	372	16	0	0	457
1955	82	792	24	1	0	899
1956	90	969	37	0	0	1096
1957	86	542	28	2	0	658
1958	88	566	46	8	0	708
1959	44	500	153	12	0	709
1960	33	384	282	9	0	708
1961	20	248	300	2	1	571
1962	50	293	197	2	0	542
1963	45	299	252	9	0	605
1964	71	323	280	6	0	680
1965	104	430	212	5	0	751
1966	120	238	94	5	0	457
1967	131	187	56	2	0	376
1968	123	156	41	3	0	323
1969	98	127	44	1	0	270
1970	89	103	29	0	1	222
1971	128	108	27	0	0	263
1972	127	202	45	2	0	376
1973	191	221	78	1	0	491
1974	297	170	88	1	0	556
1975	398	147	88	2	0	635
1976	236	182	90	4	0	512
1977	282	259	64	2	0	607
1978	284	315	105	15	0	719
1979	287	389	189	17	0	882
1980	388	494	220	6	1	1109
1981	336	408	132	5	0	881
1982	330	492	200	2	0	1024
1983	402	656	253	8	0	1319
1984	552	886	278	5	0	1721
1985	724	926	297	12	0	1959
1986	264	680	192	5	0	1141
1987	390	848	222	2	0	1462
1988	420	750	165	10	0	1345
1989	202	340	70	2	0	614
1990	6	9	1	0	0	16
Total	8293	15681	4908	169	3	29054

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SWOIL001

Cumulative Drilling Statistics
Sweet - Oil Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	301	96	3	0	0	400
1951	380	214	5	0	0	599
1952	584	430	7	0	0	1021
1953	706	670	13	1	0	1390
1954	775	1042	29	1	0	1847
1955	857	1834	53	2	0	2746
1956	947	2803	90	2	0	3842
1957	1033	3345	118	4	0	4500
1958	1121	3911	164	12	0	5208
1959	1165	4411	317	24	0	5917
1960	1198	4795	599	33	0	6625
1961	1218	5043	899	35	1	7196
1962	1268	5336	1096	37	1	7738
1963	1313	5635	1348	46	1	8343
1964	1384	5958	1628	52	1	9023
1965	1488	6388	1840	57	1	9774
1966	1608	6626	1934	62	1	10231
1967	1739	6813	1990	64	1	10607
1968	1862	6969	2031	67	1	10930
1969	1960	7096	2075	68	1	11200
1970	2049	7199	2104	68	2	11422
1971	2177	7307	2131	68	2	11685
1972	2304	7509	2176	70	2	12061
1973	2495	7730	2254	71	2	12552
1974	2792	7900	2342	72	2	13108
1975	3190	8047	2430	74	2	13743
1976	3426	8229	2520	78	2	14255
1977	3708	8488	2584	80	2	14862
1978	3992	8803	2689	95	2	15581
1979	4279	9192	2878	112	2	16463
1980	4667	9686	3098	118	3	17572
1981	5003	10094	3230	123	3	18453
1982	5333	10586	3430	125	3	19477
1983	5735	11242	3683	133	3	20796
1984	6287	12128	3961	138	3	22517
1985	7011	13054	4258	150	3	24476
1986	7275	13734	4450	155	3	25617
1987	7665	14582	4672	157	3	27079
1988	8085	15332	4837	167	3	28424
1989	8287	15672	4907	169	3	29038
1990	8293	15681	4908	169	3	29054
Total	8293	15681	4908	169	3	29054

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SWOIL002

Historical Drilling Statistics
Sweet - Gas Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	252	51	1	3	0	307
1951	38	28	2	0	0	68
1952	57	27	6	1	0	91
1953	57	29	4	1	0	91
1954	64	23	2	2	0	91
1955	49	45	5	2	0	101
1956	36	50	4	1	0	91
1957	38	29	9	0	0	76
1958	76	33	8	4	0	121
1959	111	56	9	4	0	180
1960	73	52	16	3	0	144
1961	78	50	15	2	0	145
1962	72	67	19	3	0	161
1963	104	43	12	0	0	159
1964	74	70	19	3	1	167
1965	87	47	5	1	0	140
1966	105	28	10	2	0	145
1967	91	43	12	3	0	149
1968	150	55	8	5	0	218
1969	205	53	19	2	0	279
1970	353	78	11	0	2	444
1971	461	103	10	2	0	576
1972	735	141	12	1	2	891
1973	1101	185	22	6	0	1314
1974	1190	160	23	5	2	1380
1975	1387	181	31	4	0	1603
1976	2246	305	45	11	3	2610
1977	2150	357	55	16	7	2585
1978	2140	413	105	15	7	2680
1979	2006	377	136	35	5	2559
1980	2375	571	156	43	9	3154
1981	1715	355	97	23	6	2196
1982	1496	246	74	10	4	1830
1983	518	190	39	16	0	763
1984	687	217	56	14	1	975
1985	1237	224	54	7	2	1524
1986	403	187	57	5	2	654
1987	271	280	61	14	0	626
1988	556	267	94	13	1	931
1989	268	115	25	4	0	412
1990	9	4	0	0	0	13
Total	25121	5835	1348	286	54	32644

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SWGAS001

Cumulative Drilling Statistics
Sweet - Gas Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	252	51	1	3	0	307
1951	290	79	3	3	0	375
1952	347	106	9	4	0	466
1953	404	135	13	5	0	557
1954	468	158	15	7	0	648
1955	517	203	20	9	0	749
1956	553	253	24	10	0	840
1957	591	282	33	10	0	916
1958	667	315	41	14	0	1037
1959	778	371	50	18	0	1217
1960	851	423	66	21	0	1361
1961	929	473	81	23	0	1506
1962	1001	540	100	26	0	1667
1963	1105	583	112	26	0	1826
1964	1179	653	131	29	1	1993
1965	1266	700	136	30	1	2133
1966	1371	728	146	32	1	2278
1967	1462	771	158	35	1	2427
1968	1612	826	166	40	1	2645
1969	1817	879	185	42	1	2924
1970	2170	957	196	42	3	3368
1971	2631	1060	206	44	3	3944
1972	3366	1201	218	45	5	4835
1973	4467	1386	240	51	5	6149
1974	5657	1546	263	56	7	7529
1975	7044	1727	294	60	7	9132
1976	9290	2032	339	71	10	11742
1977	11440	2389	394	87	17	14327
1978	13580	2802	499	102	24	17007
1979	15586	3179	635	137	29	19566
1980	17961	3750	791	180	38	22720
1981	19676	4105	888	203	44	24916
1982	21172	4351	962	213	48	26746
1983	21690	4541	1001	229	48	27509
1984	22377	4758	1057	243	49	28484
1985	23614	4982	1111	250	51	30008
1986	24017	5169	1168	255	53	30662
1987	24288	5449	1229	269	53	31288
1988	24844	5716	1323	282	54	32219
1989	25112	5831	1348	286	54	32631
1990	25121	5835	1348	286	54	32644
Total	25121	5835	1348	286	54	32644

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SWGAS002

Historical Drilling Statistics
Sweet - Other Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	2165	614	99	21	1	2900
1951	106	275	22	2	0	405
1952	187	353	43	4	0	587
1953	192	253	57	3	1	506
1954	152	190	64	11	0	417
1955	103	216	67	29	1	416
1956	122	284	61	17	5	489
1957	198	225	90	21	2	536
1958	319	285	89	26	3	722
1959	174	269	102	34	4	583
1960	147	253	163	22	6	591
1961	130	268	170	26	6	600
1962	152	354	171	24	5	706
1963	166	292	172	28	4	662
1964	190	421	158	22	7	798
1965	343	440	170	25	7	985
1966	332	366	135	28	3	864
1967	311	381	92	21	2	807
1968	392	477	103	34	0	1006
1969	436	480	120	32	9	1077
1970	446	396	105	27	17	991
1971	429	435	111	28	9	1012
1972	536	489	123	26	8	1182
1973	720	582	141	34	10	1487
1974	676	498	147	28	8	1357
1975	723	383	107	22	8	1243
1976	884	479	103	41	3	1510
1977	793	560	136	40	8	1537
1978	791	647	182	38	12	1670
1979	686	689	192	33	18	1618
1980	829	811	230	41	20	1931
1981	891	774	202	44	19	1930
1982	749	680	162	37	11	1639
1983	603	705	150	30	4	1492
1984	990	990	217	31	8	2236
1985	1538	1189	299	32	4	3062
1986	619	884	190	18	4	1715
1987	864	953	246	30	5	2098
1988	1300	1194	290	34	10	2828
1989	815	1019	293	38	14	2179
1990	128	160	25	1	2	316
Total	22327	21213	5799	1083	268	50690

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SWOTH001

Cumulative Drilling Statistics
Sweet - Other Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	2165	614	99	21	1	2900
1951	2271	889	121	23	1	3305
1952	2458	1242	164	27	1	3892
1953	2650	1495	221	30	2	4398
1954	2802	1685	285	41	2	4815
1955	2905	1901	352	70	3	5231
1956	3027	2185	413	87	8	5720
1957	3225	2410	503	108	10	6256
1958	3544	2695	592	134	13	6978
1959	3718	2964	694	168	17	7561
1960	3865	3217	857	190	23	8152
1961	3995	3485	1027	216	29	8752
1962	4147	3839	1198	240	34	9458
1963	4313	4131	1370	268	38	10120
1964	4503	4552	1528	290	45	10918
1965	4846	4992	1698	315	52	11903
1966	5178	5358	1833	343	55	12767
1967	5489	5739	1925	364	57	13574
1968	5881	6216	2028	398	57	14580
1969	6317	6696	2148	430	66	15657
1970	6763	7092	2253	457	83	16648
1971	7192	7527	2364	485	92	17660
1972	7728	8016	2487	511	100	18842
1973	8448	8598	2628	545	110	20329
1974	9124	9096	2775	573	118	21686
1975	9847	9479	2882	595	126	22929
1976	10731	9958	2985	636	129	24439
1977	11524	10518	3121	676	137	25976
1978	12315	11165	3303	714	149	27646
1979	13001	11854	3495	747	167	29264
1980	13830	12665	3725	788	187	31195
1981	14721	13439	3927	832	206	33125
1982	15470	14119	4089	869	217	34764
1983	16073	14824	4239	899	221	36256
1984	17063	15814	4456	930	229	38492
1985	18601	17003	4755	962	233	41554
1986	19220	17887	4945	980	237	43269
1987	20084	18840	5191	1010	242	45367
1988	21384	20034	5481	1044	252	48195
1989	22199	21053	5774	1082	266	50374
1990	22327	21213	5799	1083	268	50690
Total	22327	21213	5799	1083	268	50690

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SWOTH002

Historical Drilling Statistics
Sweet - All Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	2718	761	103	24	1	3607
1951	223	421	26	2	0	672
1952	448	596	51	5	0	1100
1953	371	522	67	5	1	966
1954	285	585	82	13	0	965
1955	234	1053	96	32	1	1416
1956	248	1303	102	18	5	1676
1957	322	796	127	23	2	1270
1958	483	884	143	38	3	1551
1959	329	825	264	50	4	1472
1960	253	689	461	34	6	1443
1961	228	566	485	30	7	1316
1962	274	714	387	29	5	1409
1963	315	634	436	37	4	1426
1964	335	814	457	31	8	1645
1965	534	917	387	31	7	1876
1966	557	632	239	35	3	1466
1967	533	611	160	26	2	1332
1968	665	688	152	42	0	1547
1969	739	660	183	35	9	1626
1970	888	577	145	27	20	1657
1971	1018	646	148	30	9	1851
1972	1398	832	180	29	10	2449
1973	2012	988	241	41	10	3292
1974	2163	828	258	34	10	3293
1975	2508	711	226	28	8	3481
1976	3366	966	238	56	6	4632
1977	3225	1176	255	58	15	4729
1978	3215	1375	392	68	19	5069
1979	2979	1455	517	85	23	5059
1980	3592	1876	606	90	30	6194
1981	2942	1537	431	72	25	5007
1982	2575	1418	436	49	15	4493
1983	1523	1551	442	54	4	3574
1984	2229	2093	551	50	9	4932
1985	3499	2339	650	51	6	6545
1986	1286	1751	439	28	6	3510
1987	1525	2081	529	46	5	4186
1988	2276	2211	549	57	11	5104
1989	1285	1474	388	44	14	3205
1990	143	173	26	1	2	345
Total	55741	42729	12055	1538	325	112388

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SWALL001

Cumulative Drilling Statistics
Sweet - All Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	2718	761	103	24	1	3607
1951	2941	1182	129	26	1	4279
1952	3389	1778	180	31	1	5379
1953	3760	2300	247	36	2	6345
1954	4045	2885	329	49	2	7310
1955	4279	3938	425	81	3	8726
1956	4527	5241	527	99	8	10402
1957	4849	6037	654	122	10	11672
1958	5332	6921	797	160	13	13223
1959	5661	7746	1061	210	17	14695
1960	5914	8435	1522	244	23	16138
1961	6142	9001	2007	274	30	17454
1962	6416	9715	2394	303	35	18863
1963	6731	10349	2830	340	39	20289
1964	7066	11163	3287	371	47	21934
1965	7600	12080	3674	402	54	23810
1966	8157	12712	3913	437	57	25276
1967	8690	13323	4073	463	59	26608
1968	9355	14011	4225	505	59	28155
1969	10094	14671	4408	540	68	29781
1970	10982	15248	4553	567	88	31438
1971	12000	15894	4701	597	97	33289
1972	13398	16726	4881	626	107	35738
1973	15410	17714	5122	667	117	39030
1974	17573	18542	5380	701	127	42323
1975	20081	19253	5606	729	135	45804
1976	23447	20219	5844	785	141	50436
1977	26672	21395	6099	843	156	55165
1978	29887	22770	6491	911	175	60234
1979	32866	24225	7008	996	198	65293
1980	36458	26101	7614	1086	228	71487
1981	39400	27638	8045	1158	253	76494
1982	41975	29056	8481	1207	268	80987
1983	43498	30607	8923	1261	272	84561
1984	45727	32700	9474	1311	281	89493
1985	49226	35039	10124	1362	287	96038
1986	50512	36790	10563	1390	293	99548
1987	52037	38871	11092	1436	298	103734
1988	54313	41082	11641	1493	309	108838
1989	55598	42556	12029	1537	323	112043
1990	55741	42729	12055	1538	325	112388
Total	55741	42729	12055	1538	325	112388

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SWALL002

Table 3.21

Historical Drilling Statistics
Sour - Oil Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	577	788	270	1	0	1636
1951	94	434	9	0	0	537
1952	13	423	47	0	0	483
1953	1	268	109	0	0	378
1954	3	108	74	3	0	188
1955	1	86	70	4	0	161
1956	3	65	119	2	0	189
1957	2	45	112	1	0	160
1958	3	37	176	12	0	228
1959	2	16	82	11	1	112
1960	2	21	116	14	1	154
1961	2	39	114	9	0	164
1962	0	41	70	3	0	114
1963	4	54	148	4	0	210
1964	13	48	106	1	0	168
1965	8	41	39	3	0	91
1966	11	78	45	2	0	136
1967	9	170	20	5	0	204
1968	21	171	15	2	0	209
1969	11	105	20	2	2	140
1970	3	48	24	0	0	75
1971	7	54	19	0	1	81
1972	19	58	26	1	0	104
1973	15	45	26	3	0	89
1974	22	46	22	1	1	92
1975	11	30	17	1	0	59
1976	15	59	15	4	0	93
1977	26	51	23	8	0	108
1978	28	74	52	9	0	163
1979	47	110	77	11	1	246
1980	38	123	66	16	0	243
1981	45	113	41	9	0	208
1982	29	181	68	5	1	284
1983	60	250	76	7	1	394
1984	88	258	116	3	0	465
1985	73	298	127	6	0	504
1986	68	214	66	17	0	365
1987	136	216	84	15	0	451
1988	259	315	59	5	0	638
1989	163	175	25	2	0	365
1990	2	3	0	0	0	5
Total	1934	5759	2790	202	9	10694

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SROIL001

Cumulative Drilling Statistics
Sour - Oil Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	577	788	270	1	0	1636
1951	671	1222	279	1	0	2173
1952	684	1645	326	1	0	2656
1953	685	1913	435	1	0	3034
1954	688	2021	509	4	0	3222
1955	689	2107	579	8	0	3383
1956	692	2172	698	10	0	3572
1957	694	2217	810	11	0	3732
1958	697	2254	986	23	0	3960
1959	699	2270	1068	34	1	4072
1960	701	2291	1184	48	2	4226
1961	703	2330	1298	57	2	4390
1962	703	2371	1368	60	2	4504
1963	707	2425	1516	64	2	4714
1964	720	2473	1622	65	2	4882
1965	728	2514	1661	68	2	4973
1966	739	2592	1706	70	2	5109
1967	748	2762	1726	75	2	5313
1968	769	2933	1741	77	2	5522
1969	780	3038	1761	79	4	5662
1970	783	3086	1785	79	4	5737
1971	790	3140	1804	79	5	5818
1972	809	3198	1830	80	5	5922
1973	824	3243	1856	83	5	6011
1974	846	3289	1878	84	6	6103
1975	857	3319	1895	85	6	6162
1976	872	3378	1910	89	6	6255
1977	898	3429	1933	97	6	6363
1978	926	3503	1985	106	6	6526
1979	973	3613	2062	117	7	6772
1980	1011	3736	2128	133	7	7015
1981	1056	3849	2169	142	7	7223
1982	1085	4030	2237	147	8	7507
1983	1145	4280	2313	154	9	7901
1984	1233	4538	2429	157	9	8366
1985	1306	4836	2556	163	9	8870
1986	1374	5050	2622	180	9	9235
1987	1510	5266	2706	195	9	9686
1988	1769	5581	2765	200	9	10324
1989	1932	5756	2790	202	9	10689
1990	1934	5759	2790	202	9	10694
Total	1934	5759	2790	202	9	10694

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SROIL002

Historical Drilling Statistics
Sour - Gas Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	87	126	30	3	1	247
1951	13	22	4	4	0	43
1952	24	24	5	1	0	54
1953	7	15	16	4	0	42
1954	5	10	9	2	0	26
1955	7	12	8	2	0	29
1956	6	16	16	3	1	42
1957	1	23	12	8	1	45
1958	6	20	20	6	4	56
1959	7	24	14	7	3	55
1960	6	24	23	14	5	72
1961	6	30	43	18	0	97
1962	6	18	33	7	0	64
1963	1	17	25	11	0	54
1964	7	23	14	8	1	53
1965	10	19	28	12	1	70
1966	4	21	35	12	0	72
1967	6	41	49	17	2	115
1968	15	50	19	54	4	142
1969	17	23	26	32	7	105
1970	21	22	27	29	5	104
1971	28	30	11	14	3	86
1972	37	24	26	9	3	99
1973	48	35	30	13	4	130
1974	57	28	21	18	3	127
1975	93	42	33	26	1	195
1976	174	62	42	29	13	320
1977	135	74	46	34	21	310
1978	113	103	67	41	18	342
1979	122	115	94	40	20	391
1980	115	162	103	66	19	465
1981	109	103	76	45	14	347
1982	48	74	41	14	2	179
1983	29	65	24	10	2	130
1984	47	78	41	15	1	182
1985	48	113	58	18	4	241
1986	54	85	44	15	3	201
1987	64	93	32	20	3	212
1988	104	142	53	20	7	326
1989	74	71	29	1	0	175
1990	0	0	0	0	0	0
Total	1761	2079	1327	702	176	6045

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SRGAS001

Cumulative Drilling Statistics
Sour - Gas Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	87	126	30	3	1	247
1951	100	148	34	7	1	290
1952	124	172	39	8	1	344
1953	131	187	55	12	1	386
1954	136	197	64	14	1	412
1955	143	209	72	16	1	441
1956	149	225	88	19	2	483
1957	150	248	100	27	3	528
1958	156	268	120	33	7	584
1959	163	292	134	40	10	639
1960	169	316	157	54	15	711
1961	175	346	200	72	15	808
1962	181	364	233	79	15	872
1963	182	381	258	90	15	926
1964	189	404	272	98	16	979
1965	199	423	300	110	17	1049
1966	203	444	335	122	17	1121
1967	209	485	384	139	19	1236
1968	224	535	403	193	23	1378
1969	241	558	429	225	30	1483
1970	262	580	456	254	35	1587
1971	290	610	467	268	38	1673
1972	327	634	493	277	41	1772
1973	375	669	523	290	45	1902
1974	432	697	544	308	48	2029
1975	525	739	577	334	49	2224
1976	699	801	619	363	62	2544
1977	834	875	665	397	83	2854
1978	947	978	732	438	101	3196
1979	1069	1093	826	478	121	3587
1980	1184	1255	929	544	140	4052
1981	1293	1358	1005	589	154	4399
1982	1341	1432	1046	603	156	4578
1983	1370	1497	1070	613	158	4708
1984	1417	1575	1111	628	159	4890
1985	1465	1688	1169	646	163	5131
1986	1519	1773	1213	661	166	5332
1987	1583	1866	1245	681	169	5544
1988	1687	2008	1298	701	176	5870
1989	1761	2079	1327	702	176	6045
1990	1761	2079	1327	702	176	6045
Total	1761	2079	1327	702	176	6045

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SRGAS002

Historical Drilling Statistics
Sour - Other Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	102	54	22	2	0	180
1951	13	19	1	2	0	35
1952	10	32	6	1	0	49
1953	8	31	4	0	1	44
1954	11	6	7	1	0	25
1955	8	14	8	3	0	33
1956	10	7	8	2	0	27
1957	7	8	18	2	3	38
1958	8	8	13	6	1	36
1959	9	8	13	8	4	42
1960	11	9	23	3	5	51
1961	17	10	25	3	0	55
1962	7	10	20	4	2	43
1963	6	7	17	5	1	36
1964	8	8	18	10	0	44
1965	13	18	15	7	0	53
1966	15	13	20	1	1	50
1967	28	35	12	4	0	79
1968	40	45	14	9	1	109
1969	10	33	21	10	7	81
1970	11	23	9	8	15	66
1971	14	22	15	7	6	64
1972	13	26	17	12	6	74
1973	29	22	11	4	4	70
1974	22	15	12	10	3	62
1975	20	21	5	7	6	59
1976	27	17	13	10	7	74
1977	34	26	13	23	8	104
1978	28	32	30	9	9	108
1979	24	56	45	9	9	143
1980	36	62	58	20	9	185
1981	46	75	39	26	6	192
1982	39	73	33	12	3	160
1983	22	79	34	10	1	146
1984	49	78	31	5	4	167
1985	33	104	49	11	3	200
1986	42	60	40	8	4	154
1987	28	82	25	16	5	156
1988	97	101	36	9	6	249
1989	60	66	21	3	1	151
1990	0	0	0	0	0	0
Total	1015	1415	821	302	141	3694

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SROTH001

Cumulative Drilling Statistics
Sour - Other Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	102	54	22	2	0	180
1951	115	73	23	4	0	215
1952	125	105	29	5	0	264
1953	133	136	33	5	1	308
1954	144	142	40	6	1	333
1955	152	156	48	9	1	366
1956	162	163	56	11	1	393
1957	169	171	74	13	4	431
1958	177	179	87	19	5	467
1959	186	187	100	27	9	509
1960	197	196	123	30	14	560
1961	214	206	148	33	14	615
1962	221	216	168	37	16	658
1963	227	223	185	42	17	694
1964	235	231	203	52	17	738
1965	248	249	218	59	17	791
1966	263	262	238	60	18	841
1967	291	297	250	64	18	920
1968	331	342	264	73	19	1029
1969	341	375	285	83	26	1110
1970	352	398	294	91	41	1176
1971	366	420	309	98	47	1240
1972	379	446	326	110	53	1314
1973	408	468	337	114	57	1384
1974	430	483	349	124	60	1446
1975	450	504	354	131	66	1505
1976	477	521	367	141	73	1579
1977	511	547	380	164	81	1683
1978	539	579	410	173	90	1791
1979	563	635	455	182	99	1934
1980	599	697	513	202	108	2119
1981	645	772	552	228	114	2311
1982	684	845	585	240	117	2471
1983	706	924	619	250	118	2617
1984	755	1002	650	255	122	2784
1985	788	1106	699	266	125	2984
1986	830	1166	739	274	129	3138
1987	858	1248	764	290	134	3294
1988	955	1349	800	299	140	3543
1989	1015	1415	821	302	141	3694
1990	1015	1415	821	302	141	3694
Total	1015	1415	821	302	141	3694

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SROTH002

Historical Drilling Statistics
Sour - All Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	766	968	322	6	1	2063
1951	120	475	14	6	0	615
1952	47	479	58	2	0	586
1953	16	314	129	4	1	464
1954	19	124	90	6	0	239
1955	16	112	86	9	0	223
1956	19	88	143	7	1	258
1957	10	76	142	11	4	243
1958	17	65	209	24	5	320
1959	18	48	109	26	8	209
1960	19	54	162	31	11	277
1961	25	79	182	30	0	316
1962	13	69	123	14	2	221
1963	11	78	190	20	1	300
1964	28	79	138	19	1	265
1965	31	78	82	22	1	214
1966	30	112	100	15	1	258
1967	43	246	81	26	2	398
1968	76	266	48	65	5	460
1969	38	161	67	44	16	326
1970	35	93	60	37	20	245
1971	49	106	45	21	10	231
1972	69	108	69	22	9	277
1973	92	102	67	20	8	289
1974	101	89	55	29	7	281
1975	124	93	55	34	7	313
1976	216	138	70	43	20	487
1977	195	151	82	65	29	522
1978	169	209	149	59	27	613
1979	193	281	216	60	30	780
1980	189	347	227	102	28	893
1981	200	291	156	80	20	747
1982	116	328	142	31	6	623
1983	111	394	134	27	4	670
1984	184	414	188	23	5	814
1985	154	515	234	35	7	945
1986	164	359	150	40	7	720
1987	228	391	141	51	8	819
1988	460	558	148	34	13	1213
1989	297	312	75	6	1	691
1990	2	3	0	0	0	5
Total	4710	9253	4938	1206	326	20433

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SRALL001

Cumulative Drilling Statistics
Sour - All Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre1951	766	968	322	6	1	2063
1951	886	1443	336	12	1	2678
1952	933	1922	394	14	1	3264
1953	949	2236	523	18	2	3728
1954	968	2360	613	24	2	3967
1955	984	2472	699	33	2	4190
1956	1003	2560	842	40	3	4448
1957	1013	2636	984	51	7	4691
1958	1030	2701	1193	75	12	5011
1959	1048	2749	1302	101	20	5220
1960	1067	2803	1464	132	31	5497
1961	1092	2882	1646	162	31	5813
1962	1105	2951	1769	176	33	6034
1963	1116	3029	1959	196	34	6334
1964	1144	3108	2097	215	35	6599
1965	1175	3186	2179	237	36	6813
1966	1205	3298	2279	252	37	7071
1967	1248	3544	2360	278	39	7469
1968	1324	3810	2408	343	44	7929
1969	1362	3971	2475	387	60	8255
1970	1397	4064	2535	424	80	8500
1971	1446	4170	2580	445	90	8731
1972	1515	4278	2649	467	99	9008
1973	1607	4380	2716	487	107	9297
1974	1708	4469	2771	516	114	9578
1975	1832	4562	2826	550	121	9891
1976	2048	4700	2896	593	141	10378
1977	2243	4851	2978	658	170	10900
1978	2412	5060	3127	717	197	11513
1979	2605	5341	3343	777	227	12293
1980	2794	5688	3570	879	255	13186
1981	2994	5979	3726	959	275	13933
1982	3110	6307	3868	990	281	14556
1983	3221	6701	4002	1017	285	15226
1984	3405	7115	4190	1040	290	16040
1985	3559	7630	4424	1075	297	16985
1986	3723	7989	4574	1115	304	17705
1987	3951	8380	4715	1166	312	18524
1988	4411	8938	4863	1200	325	19737
1989	4708	9250	4938	1206	326	20428
1990	4710	9253	4938	1206	326	20433
Total	4710	9253	4938	1206	326	20433

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SRALL002

Table 3.22

Historical Drilling Statistics
Sweet & Sour - Oil Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	878	884	273	1	0	2036
1951	173	552	11	0	0	736
1952	217	639	49	0	0	905
1953	123	508	115	1	0	747
1954	72	480	90	3	0	645
1955	83	878	94	5	0	1060
1956	93	1034	156	2	0	1285
1957	88	587	140	3	0	818
1958	91	603	222	20	0	936
1959	46	516	235	23	1	821
1960	35	405	398	23	1	862
1961	22	287	414	11	1	735
1962	50	334	267	5	0	656
1963	49	353	400	13	0	815
1964	84	371	386	7	0	848
1965	112	471	251	8	0	842
1966	131	316	139	7	0	593
1967	140	357	76	7	0	580
1968	144	327	56	5	0	532
1969	109	232	64	3	2	410
1970	92	151	53	0	1	297
1971	135	162	46	0	1	344
1972	146	260	71	3	0	480
1973	206	266	104	4	0	580
1974	319	216	110	2	1	648
1975	409	177	105	3	0	694
1976	251	241	105	8	0	605
1977	308	310	87	10	0	715
1978	312	389	157	24	0	882
1979	334	499	266	28	1	1128
1980	426	617	286	22	1	1352
1981	381	521	173	14	0	1089
1982	359	673	268	7	1	1308
1983	462	906	329	15	1	1713
1984	640	1144	394	8	0	2186
1985	797	1224	424	18	0	2463
1986	332	894	258	22	0	1506
1987	526	1064	306	17	0	1913
1988	679	1065	224	15	0	1983
1989	365	515	95	4	0	979
1990	8	12	1	0	0	21
Total	10227	21440	7698	371	12	39748

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SSOIL001

Cumulative Drilling Statistics
Sweet & Sour - Oil Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	878	884	273	1	0	2036
1951	1051	1436	284	1	0	2772
1952	1268	2075	333	1	0	3677
1953	1391	2583	448	2	0	4424
1954	1463	3063	538	5	0	5069
1955	1546	3941	632	10	0	6129
1956	1639	4975	788	12	0	7414
1957	1727	5562	928	15	0	8232
1958	1818	6165	1150	35	0	9168
1959	1864	6681	1385	58	1	9989
1960	1899	7086	1783	81	2	10851
1961	1921	7373	2197	92	3	11586
1962	1971	7707	2464	97	3	12242
1963	2020	8060	2864	110	3	13057
1964	2104	8431	3250	117	3	13905
1965	2216	8902	3501	125	3	14747
1966	2347	9218	3640	132	3	15340
1967	2487	9575	3716	139	3	15920
1968	2631	9902	3772	144	3	16452
1969	2740	10134	3836	147	5	16862
1970	2832	10285	3889	147	6	17159
1971	2967	10447	3935	147	7	17503
1972	3113	10707	4006	150	7	17983
1973	3319	10973	4110	154	7	18563
1974	3638	11189	4220	156	8	19211
1975	4047	11366	4325	159	8	19905
1976	4298	11607	4430	167	8	20510
1977	4606	11917	4517	177	8	21225
1978	4918	12306	4674	201	8	22107
1979	5252	12805	4940	229	9	23235
1980	5678	13422	5226	251	10	24587
1981	6059	13943	5399	265	10	25676
1982	6418	14616	5667	272	11	26984
1983	6880	15522	5996	287	12	28697
1984	7520	16666	6390	295	12	30883
1985	8317	17890	6814	313	12	33346
1986	8649	18784	7072	335	12	34852
1987	9175	19848	7378	352	12	36765
1988	9854	20913	7602	367	12	38748
1989	10219	21428	7697	371	12	39727
1990	10227	21440	7698	371	12	39748
Total	10227	21440	7698	371	12	39748

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SSOIL002

Historical Drilling Statistics
Sweet & Sour - Gas Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	339	177	31	6	1	554
1951	51	50	6	4	0	111
1952	81	51	11	2	0	145
1953	64	44	20	5	0	133
1954	69	33	11	4	0	117
1955	56	57	13	4	0	130
1956	42	66	20	4	1	133
1957	39	52	21	8	1	121
1958	82	53	28	10	4	177
1959	118	80	23	11	3	235
1960	79	76	39	17	5	216
1961	84	80	58	20	0	242
1962	78	85	52	10	0	225
1963	105	60	37	11	0	213
1964	81	93	33	11	2	220
1965	97	66	33	13	1	210
1966	109	49	45	14	0	217
1967	97	84	61	20	2	264
1968	165	105	27	59	4	360
1969	222	76	45	34	7	384
1970	374	100	38	29	7	548
1971	489	133	21	16	3	662
1972	772	165	38	10	5	990
1973	1149	220	52	19	4	1444
1974	1247	188	44	23	5	1507
1975	1480	223	64	30	1	1798
1976	2420	367	87	40	16	2930
1977	2285	431	101	50	28	2895
1978	2253	516	172	56	25	3022
1979	2128	492	230	75	25	2950
1980	2490	733	259	109	28	3619
1981	1824	458	173	68	20	2543
1982	1544	320	115	24	6	2009
1983	547	255	63	26	2	893
1984	734	295	97	29	2	1157
1985	1285	337	112	25	6	1765
1986	457	272	101	20	5	855
1987	335	373	93	34	3	838
1988	660	409	147	33	8	1257
1989	342	186	54	5	0	587
1990	9	4	0	0	0	13
Total	26882	7914	2675	988	230	38689

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SSGAS001

Cumulative Drilling Statistics
Sweet & Sour - Gas Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	339	177	31	6	1	554
1951	390	227	37	10	1	665
1952	471	278	48	12	1	810
1953	535	322	68	17	1	943
1954	604	355	79	21	1	1060
1955	660	412	92	25	1	1190
1956	702	478	112	29	2	1323
1957	741	530	133	37	3	1444
1958	823	583	161	47	7	1621
1959	941	663	184	58	10	1856
1960	1020	739	223	75	15	2072
1961	1104	819	281	95	15	2314
1962	1182	904	333	105	15	2539
1963	1287	964	370	116	15	2752
1964	1368	1057	403	127	17	2972
1965	1465	1123	436	140	18	3182
1966	1574	1172	481	154	18	3399
1967	1671	1256	542	174	20	3663
1968	1836	1361	569	233	24	4023
1969	2058	1437	614	267	31	4407
1970	2432	1537	652	296	38	4955
1971	2921	1670	673	312	41	5617
1972	3693	1835	711	322	46	6607
1973	4842	2055	763	341	50	8051
1974	6089	2243	807	364	55	9558
1975	7569	2466	871	394	56	11356
1976	9989	2833	958	434	72	14286
1977	12274	3264	1059	484	100	17181
1978	14527	3780	1231	540	125	20203
1979	16655	4272	1461	615	150	23153
1980	19145	5005	1720	724	178	26772
1981	20969	5463	1893	792	198	29315
1982	22513	5783	2008	816	204	31324
1983	23060	6038	2071	842	206	32217
1984	23794	6333	2168	871	208	33374
1985	25079	6670	2280	896	214	35139
1986	25536	6942	2381	916	219	35994
1987	25871	7315	2474	950	222	36832
1988	26531	7724	2621	983	230	38089
1989	26873	7910	2675	988	230	38676
1990	26882	7914	2675	988	230	38689
Total	26882	7914	2675	988	230	38689

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SSGAS002

Historical Drilling Statistics
Sweet & Sour - Other Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	2267	668	121	23	1	3080
1951	119	294	23	4	0	440
1952	197	385	49	5	0	636
1953	200	284	61	3	2	550
1954	163	196	71	12	0	442
1955	111	230	75	32	1	449
1956	132	291	69	19	5	516
1957	205	233	108	23	5	574
1958	327	293	102	32	4	758
1959	183	277	115	42	8	625
1960	158	262	186	25	11	642
1961	147	278	195	29	6	655
1962	159	364	191	28	7	749
1963	172	299	189	33	5	698
1964	198	429	176	32	7	842
1965	356	458	185	32	7	1038
1966	347	379	155	29	4	914
1967	339	416	104	25	2	886
1968	432	522	117	43	1	1115
1969	446	513	141	42	16	1158
1970	457	419	114	35	32	1057
1971	443	457	126	35	15	1076
1972	549	515	140	38	14	1256
1973	749	604	152	38	14	1557
1974	698	513	159	38	11	1419
1975	743	404	112	29	14	1302
1976	911	496	116	51	10	1584
1977	827	586	149	63	16	1641
1978	819	679	212	47	21	1778
1979	710	745	237	42	27	1761
1980	865	873	288	61	29	2116
1981	937	849	241	70	25	2122
1982	788	753	195	49	14	1799
1983	625	784	184	40	5	1638
1984	1039	1068	248	36	12	2403
1985	1571	1293	348	43	7	3262
1986	661	944	230	26	8	1869
1987	892	1035	271	46	10	2254
1988	1397	1295	326	43	16	3077
1989	875	1085	314	41	15	2330
1990	128	160	25	1	2	316
Total	23342	22628	6620	1385	409	54384

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SSOTH001

Cumulative Drilling Statistics
Sweet & Sour - Other Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	2267	668	121	23	1	3080
1951	2386	962	144	27	1	3520
1952	2583	1347	193	32	1	4156
1953	2783	1631	254	35	3	4706
1954	2946	1827	325	47	3	5148
1955	3057	2057	400	79	4	5597
1956	3189	2348	469	98	9	6113
1957	3394	2581	577	121	14	6687
1958	3721	2874	679	153	18	7445
1959	3904	3151	794	195	26	8070
1960	4062	3413	980	220	37	8712
1961	4209	3691	1175	249	43	9367
1962	4368	4055	1366	277	50	10116
1963	4540	4354	1555	310	55	10814
1964	4738	4783	1731	342	62	11656
1965	5094	5241	1916	374	69	12694
1966	5441	5620	2071	403	73	13608
1967	5780	6036	2175	428	75	14494
1968	6212	6558	2292	471	76	15609
1969	6658	7071	2433	513	92	16767
1970	7115	7490	2547	548	124	17824
1971	7558	7947	2673	583	139	18900
1972	8107	8462	2813	621	153	20156
1973	8856	9066	2965	659	167	21713
1974	9554	9579	3124	697	178	23132
1975	10297	9983	3236	726	192	24434
1976	11208	10479	3352	777	202	26018
1977	12035	11065	3501	840	218	27659
1978	12854	11744	3713	887	239	29437
1979	13564	12489	3950	929	266	31198
1980	14429	13362	4238	990	295	33314
1981	15366	14211	4479	1060	320	35436
1982	16154	14964	4674	1109	334	37235
1983	16779	15748	4858	1149	339	38873
1984	17818	16816	5106	1185	351	41276
1985	19389	18109	5454	1228	358	44538
1986	20050	19053	5684	1254	366	46407
1987	20942	20088	5955	1300	376	48661
1988	22339	21383	6281	1343	392	51738
1989	23214	22468	6595	1384	407	54068
1990	23342	22628	6620	1385	409	54384
Total	23342	22628	6620	1385	409	54384

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SSOTH002

Historical Drilling Statistics
Sweet & Sour - All Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	3484	1729	425	30	2	5670
1951	343	896	40	8	0	1287
1952	495	1075	109	7	0	1686
1953	387	836	196	9	2	1430
1954	304	709	172	19	0	1204
1955	250	1165	182	41	1	1639
1956	267	1391	245	25	6	1934
1957	332	872	269	34	6	1513
1958	500	949	352	62	8	1871
1959	347	873	373	76	12	1681
1960	272	743	623	65	17	1720
1961	253	645	667	60	7	1632
1962	287	783	510	43	7	1630
1963	326	712	626	57	5	1726
1964	363	893	595	50	9	1910
1965	565	995	469	53	8	2090
1966	587	744	339	50	4	1724
1967	576	857	241	52	4	1730
1968	741	954	200	107	5	2007
1969	777	821	250	79	25	1952
1970	923	670	205	64	40	1902
1971	1067	752	193	51	19	2082
1972	1467	940	249	51	19	2726
1973	2104	1090	308	61	18	3581
1974	2264	917	313	63	17	3574
1975	2632	804	281	62	15	3794
1976	3582	1104	308	99	26	5119
1977	3420	1327	337	123	44	5251
1978	3384	1584	541	127	46	5682
1979	3172	1736	733	145	53	5839
1980	3781	2223	833	192	58	7087
1981	3142	1828	587	152	45	5754
1982	2691	1746	578	80	21	5116
1983	1634	1945	576	81	8	4244
1984	2413	2507	739	73	14	5746
1985	3653	2854	884	86	13	7490
1986	1450	2110	589	68	13	4230
1987	1753	2472	670	97	13	5005
1988	2736	2769	697	91	24	6317
1989	1582	1786	463	50	15	3896
1990	145	176	26	1	2	350
Total	60451	51982	16993	2744	651	132821

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SSAll001

Cumulative Drilling Statistics
Sweet & Sour - All Wells by Depth

Year	0 to 999 m	1000 to 1999 m	2000 to 2999 m	3000 to 3999 m	4000 to 9999 m	Total
Pre 1951	3484	1729	425	30	2	5670
1951	3827	2625	465	38	2	6957
1952	4322	3700	574	45	2	8643
1953	4709	4536	770	54	4	10073
1954	5013	5245	942	73	4	11277
1955	5263	6410	1124	114	5	12916
1956	5530	7801	1369	139	11	14850
1957	5862	8673	1638	173	17	16363
1958	6362	9622	1990	235	25	18234
1959	6709	10495	2363	311	37	19915
1960	6981	11238	2986	376	54	21635
1961	7234	11883	3653	436	61	23267
1962	7521	12666	4163	479	68	24897
1963	7847	13378	4789	536	73	26623
1964	8210	14271	5384	586	82	28533
1965	8775	15266	5853	639	90	30623
1966	9362	16010	6192	689	94	32347
1967	9938	16867	6433	741	98	34077
1968	10679	17821	6633	848	103	36084
1969	11456	18642	6883	927	128	38036
1970	12379	19312	7088	991	168	39938
1971	13446	20064	7281	1042	187	42020
1972	14913	21004	7530	1093	206	44746
1973	17017	22094	7838	1154	224	48327
1974	19281	23011	8151	1217	241	51901
1975	21913	23815	8432	1279	256	55695
1976	25495	24919	8740	1378	282	60814
1977	28915	26246	9077	1501	326	66065
1978	32299	27830	9618	1628	372	71747
1979	35471	29566	10351	1773	425	77586
1980	39252	31789	11184	1965	483	84673
1981	42394	33617	11771	2117	528	90427
1982	45085	35363	12349	2197	549	95543
1983	46719	37308	12925	2278	557	99787
1984	49132	39815	13664	2351	571	105533
1985	52785	42669	14548	2437	584	113023
1986	54235	44779	15137	2505	597	117253
1987	55988	47251	15807	2602	610	122258
1988	58724	50020	16504	2693	634	128575
1989	60306	51806	16967	2743	649	132471
1990	60451	51982	16993	2744	651	132821
Total	60451	51982	16993	2744	651	132821

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1).
SSALL002

Table 3.23

Historical Drilling Statistics
Sweet - 0 to 999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	16	46	1153	1215	284	170	808	1262	1	36	204	241	301	252	2165	2718
1951	10	17	65	92	69	18	34	121	0	3	7	10	79	38	106	223
1952	24	25	104	153	180	32	77	289	0	0	6	6	204	57	187	448
1953	22	19	112	153	100	38	70	208	0	0	10	10	122	57	192	371
1954	15	17	91	123	54	45	51	150	0	2	10	12	69	64	152	285
1955	2	17	56	75	79	32	41	152	1	0	6	7	82	49	103	234
1956	7	18	57	82	83	17	35	135	0	1	30	31	90	36	122	248
1957	9	22	102	133	77	14	29	120	0	2	67	69	86	38	198	322
1958	7	21	92	120	81	51	39	171	0	4	188	192	88	76	319	483
1959	3	25	87	115	41	80	24	145	0	6	63	69	44	111	174	329
1960	7	26	83	116	26	44	18	88	0	3	46	49	33	73	147	253
1961	1	23	59	83	19	54	28	101	0	1	43	44	20	78	130	228
1962	6	17	62	85	44	53	42	139	0	2	48	50	50	72	152	274
1963	9	17	80	106	36	86	51	173	0	1	35	36	45	104	166	315
1964	10	30	107	147	61	41	40	142	0	3	43	46	71	74	190	335
1965	27	32	230	289	77	52	79	208	0	3	34	37	104	87	343	534
1966	19	36	211	266	101	67	89	257	0	2	32	34	120	105	332	557
1967	13	23	162	198	118	67	119	304	0	1	30	31	131	91	311	533
1968	13	37	179	229	110	109	174	393	0	4	39	43	123	150	392	665
1969	12	41	245	298	86	160	142	388	0	4	49	53	98	205	436	739
1970	3	93	309	405	86	259	104	449	0	1	33	34	89	353	446	888
1971	25	116	267	408	103	343	134	580	0	2	28	30	128	461	429	1018
1972	9	143	330	482	118	592	182	892	0	0	24	24	127	735	536	1398
1973	26	338	453	817	164	762	249	1175	1	1	18	20	191	1101	720	2012
1974	17	218	410	645	279	972	257	1508	1	0	9	10	297	1190	676	2163
1975	18	282	422	722	380	1102	282	1764	0	3	19	22	398	1387	723	2508
1976	29	672	474	1175	206	1573	384	2163	1	1	26	28	236	2246	884	3366
1977	56	587	496	1139	224	1562	286	2072	2	1	11	14	282	2150	793	3225
1978	40	454	445	939	243	1686	339	2268	1	0	7	8	284	2140	791	3215
1979	29	287	333	649	258	1715	347	2320	0	4	6	10	287	2006	686	2979
1980	40	428	370	838	348	1947	450	2745	0	0	9	9	388	2375	829	3592
1981	33	301	469	803	303	1414	411	2128	0	0	11	11	336	1715	891	2942
1982	28	156	360	544	302	1338	378	2018	0	2	11	13	330	1496	749	2575
1983	13	62	175	250	389	456	425	1270	0	0	3	3	402	518	603	1523
1984	45	96	258	399	503	590	711	1804	4	1	21	26	552	687	990	2229
1985	65	83	294	442	656	1154	1184	2994	3	0	60	63	724	1237	1538	3499
1986	25	72	202	299	238	331	394	963	1	0	23	24	264	403	619	1286
1987	36	65	216	317	353	206	635	1194	1	0	13	14	390	271	864	1525
1988	48	123	313	484	371	429	928	1728	1	4	59	64	420	556	1300	2276
1989	22	56	456	534	180	212	337	729	0	0	22	22	202	268	815	1285
1990	2	3	61	66	4	6	67	77	0	0	0	0	6	9	128	143
Total	841	5144	10450	16435	7434	19879	10474	37787	18	98	1403	1519	8293	25121	22327	55741

Historical Drilling Statistics
Sweet - 1000 to 1999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	21	33	434	488	75	17	179	271	0	1	1	2	96	51	614	761
1951	15	22	205	242	103	6	70	179	0	0	0	0	118	28	275	421
1952	21	24	241	286	195	3	112	310	0	0	0	0	216	27	353	596
1953	16	22	158	196	222	7	95	324	2	0	0	2	240	29	253	522
1954	21	15	122	158	351	8	68	427	0	0	0	0	372	23	190	585
1955	39	25	115	179	753	19	101	873	0	1	0	1	792	45	216	1053
1956	26	23	170	219	943	25	114	1082	0	2	0	2	969	50	284	1303
1957	43	14	173	230	497	13	52	562	2	2	0	4	542	29	225	796
1958	20	13	161	194	546	19	123	688	0	1	1	2	566	33	285	884
1959	30	37	176	243	470	19	93	582	0	0	0	0	500	56	269	825
1960	17	28	145	190	367	24	107	498	0	0	1	1	384	52	253	689
1961	18	17	157	192	230	33	111	374	0	0	0	0	248	50	268	566
1962	15	27	181	223	278	40	172	490	0	0	1	1	293	67	354	714
1963	23	24	161	208	276	19	131	426	0	0	0	0	299	43	292	634
1964	45	43	274	362	278	27	147	452	0	0	0	0	323	70	421	814
1965	63	30	280	373	367	17	160	544	0	0	0	0	430	47	440	917
1966	21	23	265	309	217	5	101	323	0	0	0	0	238	28	366	632
1967	24	28	280	332	163	15	101	279	0	0	0	0	187	43	381	611
1968	36	37	377	450	119	18	99	236	1	0	1	2	156	55	477	688
1969	24	39	374	437	103	14	106	223	0	0	0	0	127	53	480	660
1970	20	53	314	387	83	25	81	189	0	0	1	1	103	78	396	577
1971	20	53	285	358	88	50	141	279	0	0	9	9	108	103	435	646
1972	19	77	362	458	183	64	127	374	0	0	0	0	202	141	489	832
1973	42	124	387	553	179	59	187	425	0	2	8	10	221	185	582	988
1974	28	88	345	461	141	72	149	362	1	0	4	5	170	160	498	828
1975	20	96	278	394	127	84	99	310	0	1	6	7	147	181	383	711
1976	48	181	332	561	134	122	142	398	0	2	5	7	182	305	479	966
1977	71	246	380	697	188	111	168	467	0	0	12	12	259	357	560	1176
1978	81	258	467	806	234	154	175	563	0	1	5	6	315	413	647	1375
1979	74	204	431	709	315	173	255	743	0	0	3	3	389	377	689	1455
1980	96	299	496	891	398	272	314	984	0	0	1	1	494	571	811	1876
1981	110	202	497	809	298	153	276	727	0	0	1	1	408	355	774	1537
1982	134	116	403	653	358	130	276	764	0	0	1	1	492	246	680	1418
1983	114	70	408	592	542	120	297	959	0	0	0	0	656	190	705	1551
1984	195	111	550	856	684	105	436	1225	7	1	4	12	886	217	990	2093
1985	241	100	695	1036	681	123	482	1286	4	1	12	17	926	224	1189	2339
1986	159	84	527	770	518	100	348	966	3	3	9	15	680	187	884	1751
1987	203	125	603	931	643	154	346	1143	2	1	4	7	848	280	953	2081
1988	172	129	722	1023	574	134	461	1169	4	4	11	19	750	267	1194	2211
1989	94	52	715	861	246	61	299	606	0	2	5	7	340	115	1019	1474
1990	5	3	98	106	4	1	60	65	0	0	2	2	9	4	160	173
Total	2484	3195	13744	19423	13171	2615	7361	23147	26	25	108	159	15681	5835	21213	42729

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD002

Historical Drilling Statistics
Sweet - 2000 to 2999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	1	0	81	82	2	1	18	21	0	0	0	0	3	1	99	103
1951	2	2	21	25	0	0	1	1	0	0	0	0	2	2	22	26
1952	2	5	39	46	0	1	4	5	0	0	0	0	2	6	43	51
1953	5	4	48	57	1	0	9	10	0	0	0	0	6	4	57	67
1954	13	2	53	68	3	0	11	14	0	0	0	0	16	2	64	82
1955	9	4	56	69	15	1	11	27	0	0	0	0	24	5	67	96
1956	15	4	54	73	22	0	7	29	0	0	0	0	37	4	61	102
1957	6	7	68	81	22	2	21	45	0	0	1	1	28	9	90	127
1958	12	7	71	90	34	0	18	52	0	1	0	1	46	8	89	143
1959	23	6	65	94	130	3	37	170	0	0	0	0	153	9	102	264
1960	24	7	99	130	258	9	64	331	0	0	0	0	282	16	163	461
1961	27	4	85	116	273	11	85	369	0	0	0	0	300	15	170	485
1962	12	9	87	108	185	10	84	279	0	0	0	0	197	19	171	387
1963	16	5	91	112	236	7	81	324	0	0	0	0	252	12	172	436
1964	32	8	93	133	248	11	65	324	0	0	0	0	280	19	158	457
1965	25	4	117	146	187	1	53	241	0	0	0	0	212	5	170	387
1966	11	6	110	127	83	4	25	112	0	0	0	0	94	10	135	239
1967	6	8	74	88	50	4	18	72	0	0	0	0	56	12	92	160
1968	4	2	82	88	37	6	21	64	0	0	0	0	41	8	103	152
1969	3	4	84	91	41	15	36	92	0	0	0	0	44	19	120	183
1970	3	6	72	81	26	5	33	64	0	0	0	0	29	11	105	145
1971	8	3	85	96	19	7	26	52	0	0	0	0	27	10	111	148
1972	7	4	92	103	38	8	31	77	0	0	0	0	45	12	123	180
1973	14	12	98	124	64	10	43	117	0	0	0	0	78	22	141	241
1974	21	16	100	137	67	7	46	120	0	0	1	1	88	23	147	258
1975	22	16	70	108	66	15	37	118	0	0	0	0	88	31	107	226
1976	31	31	75	137	59	14	28	101	0	0	0	0	90	45	103	238
1977	17	39	115	171	47	16	21	84	0	0	0	0	64	55	136	255
1978	23	83	129	235	82	20	53	155	0	2	0	2	105	105	182	392
1979	48	99	140	287	141	37	51	229	0	0	1	1	189	136	192	517
1980	54	100	168	322	166	56	62	284	0	0	0	0	220	156	230	606
1981	45	58	141	244	87	39	61	187	0	0	0	0	132	97	202	431
1982	77	45	113	235	123	29	49	201	0	0	0	0	200	74	162	436
1983	80	23	114	217	172	16	36	224	1	0	0	1	253	39	150	442
1984	74	32	170	276	199	24	46	269	5	0	1	6	278	56	217	551
1985	78	31	215	324	216	23	80	319	3	0	4	7	297	54	299	650
1986	36	25	120	181	154	32	66	252	2	0	4	6	192	57	190	439
1987	64	25	168	257	158	34	76	268	0	2	2	4	222	61	246	529
1988	55	46	200	301	109	48	85	242	1	0	5	6	165	94	290	549
1989	19	19	212	250	50	6	77	133	1	0	4	5	70	25	293	388
1990	0	0	16	16	1	0	9	10	0	0	0	0	1	0	25	26
Total	1024	811	4091	5926	3871	532	1685	6088	13	5	23	41	4908	1348	5799	12055

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD003

Historical Drilling Statistics
Sweet - 3000 to 3999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	2	11	13	0	1	10	11	0	0	0	0	0	3	21	24
1951	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	2
1952	0	1	4	5	0	0	0	0	0	0	0	0	0	1	4	5
1953	1	1	3	5	0	0	0	0	0	0	0	0	1	1	3	5
1954	0	2	11	13	0	0	0	0	0	0	0	0	0	2	11	13
1955	0	2	27	29	1	0	2	3	0	0	0	0	1	2	29	32
1956	0	1	16	17	0	0	1	1	0	0	0	0	0	1	17	18
1957	1	0	21	22	1	0	0	1	0	0	0	0	2	0	21	23
1958	2	4	20	26	6	0	6	12	0	0	0	0	8	4	26	38
1959	1	4	24	29	11	0	10	21	0	0	0	0	12	4	34	50
1960	1	2	18	21	8	1	4	13	0	0	0	0	9	3	22	34
1961	2	1	22	25	0	1	4	5	0	0	0	0	2	2	26	30
1962	1	3	19	23	1	0	5	6	0	0	0	0	2	3	24	29
1963	4	0	23	27	5	0	5	10	0	0	0	0	9	0	28	37
1964	2	3	21	26	4	0	1	5	0	0	0	0	6	3	22	31
1965	0	1	22	23	5	0	3	8	0	0	0	0	5	1	25	31
1966	2	1	21	24	3	1	7	11	0	0	0	0	5	2	28	35
1967	0	3	16	19	2	0	5	7	0	0	0	0	2	3	21	26
1968	1	2	27	30	2	3	7	12	0	0	0	0	3	5	34	42
1969	1	1	28	30	0	1	4	5	0	0	0	0	1	2	32	35
1970	0	0	24	24	0	0	3	3	0	0	0	0	0	0	27	27
1971	0	2	21	23	0	0	7	7	0	0	0	0	0	2	28	30
1972	2	1	25	28	0	0	1	1	0	0	0	0	2	1	26	29
1973	1	3	33	37	0	3	1	4	0	0	0	0	1	6	34	41
1974	1	5	25	31	0	0	3	3	0	0	0	0	1	5	28	34
1975	2	3	20	25	0	1	2	3	0	0	0	0	2	4	22	28
1976	4	10	36	50	0	1	5	6	0	0	0	0	4	11	41	56
1977	2	13	38	53	0	3	2	5	0	0	0	0	2	16	40	58
1978	13	15	34	62	2	0	4	6	0	0	0	0	15	15	38	68
1979	13	34	31	78	4	1	2	7	0	0	0	0	17	35	33	85
1980	5	41	38	84	1	2	3	6	0	0	0	0	6	43	41	90
1981	5	21	43	69	0	2	1	3	0	0	0	0	5	23	44	72
1982	1	6	36	43	1	4	1	6	0	0	0	0	2	10	37	49
1983	5	7	23	35	3	9	7	19	0	0	0	0	8	16	30	54
1984	3	4	26	33	2	9	5	16	0	1	0	1	5	14	31	50
1985	6	4	21	31	6	3	10	19	0	0	1	1	12	7	32	51
1986	2	2	10	14	2	3	8	13	1	0	0	1	5	5	18	28
1987	1	6	27	34	1	7	3	11	0	1	0	1	2	14	30	46
1988	3	4	28	35	6	8	6	20	1	1	0	2	10	13	34	57
1989	1	3	34	38	1	1	4	6	0	0	0	0	2	4	38	44
1990	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
Total	89	218	930	1237	78	65	152	295	2	3	1	6	169	286	1083	1538

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD004

Historical Drilling Statistics
Sweet - 4000 to 4999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
1956	0	0	5	5	0	0	0	0	0	0	0	0	0	0	5	5
1957	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	2
1958	0	0	2	2	0	0	1	1	0	0	0	0	0	0	3	3
1959	0	0	3	3	0	0	1	1	0	0	0	0	0	0	4	4
1960	0	0	5	5	0	0	1	1	0	0	0	0	0	0	6	6
1961	1	0	6	7	0	0	0	0	0	0	0	0	1	0	6	7
1962	0	0	2	2	0	0	3	3	0	0	0	0	0	0	5	5
1963	0	0	4	4	0	0	0	0	0	0	0	0	0	0	4	4
1964	0	1	7	8	0	0	0	0	0	0	0	0	0	1	7	8
1965	0	0	7	7	0	0	0	0	0	0	0	0	0	0	7	7
1966	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
1967	0	0	1	1	0	0	1	1	0	0	0	0	0	0	2	2
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	9	9	0	0	0	0	0	0	0	0	0	0	9	9
1970	0	2	17	19	1	0	0	1	0	0	0	0	1	2	17	20
1971	0	0	9	9	0	0	0	0	0	0	0	0	0	0	9	9
1972	0	2	8	10	0	0	0	0	0	0	0	0	0	2	8	10
1973	0	0	7	7	0	0	3	3	0	0	0	0	0	0	10	10
1974	0	2	8	10	0	0	0	0	0	0	0	0	0	2	8	10
1975	0	0	7	7	0	0	1	1	0	0	0	0	0	0	8	8
1976	0	3	3	6	0	0	0	0	0	0	0	0	0	3	3	6
1977	0	7	8	15	0	0	0	0	0	0	0	0	0	7	8	15
1978	0	6	12	18	0	1	0	1	0	0	0	0	0	7	12	19
1979	0	4	18	22	0	1	0	1	0	0	0	0	0	5	18	23
1980	1	9	18	28	0	0	2	2	0	0	0	0	1	9	20	30
1981	0	6	19	25	0	0	0	0	0	0	0	0	0	6	19	25
1982	0	4	11	15	0	0	0	0	0	0	0	0	0	4	11	15
1983	0	0	4	4	0	0	0	0	0	0	0	0	0	0	4	4
1984	0	1	8	9	0	0	0	0	0	0	0	0	0	1	8	9
1985	0	1	4	5	0	0	0	0	0	1	0	1	0	2	4	6
1986	0	2	4	6	0	0	0	0	0	0	0	0	0	2	4	6
1987	0	0	4	4	0	0	1	1	0	0	0	0	0	0	5	5
1988	0	1	10	11	0	0	0	0	0	0	0	0	0	1	10	11
1989	0	0	13	13	0	0	0	0	0	0	1	1	0	0	14	14
1990	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	2
Total	2	51	252	305	1	2	15	18	0	1	1	2	3	54	268	325

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD005

Historical Drilling Statistics
Sweet - Total of All Depths

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	38	81	1679	1798	361	189	1016	1566	1	37	205	243	400	307	2900	3607
1951	27	41	293	361	172	24	105	301	0	3	7	10	199	68	405	672
1952	47	55	388	490	375	36	193	604	0	0	6	6	422	91	587	1100
1953	44	46	322	412	323	45	174	542	2	0	10	12	369	91	506	966
1954	49	36	277	362	408	53	130	591	0	2	10	12	457	91	417	965
1955	50	48	255	353	848	52	155	1055	1	1	6	8	899	101	416	1416
1956	48	46	302	396	1048	42	157	1247	0	3	30	33	1096	91	489	1676
1957	59	43	366	468	597	29	102	728	2	4	68	74	658	76	536	1270
1958	41	45	346	432	667	70	187	924	0	6	189	195	708	121	722	1551
1959	57	72	355	484	652	102	165	919	0	6	63	69	709	180	583	1472
1960	49	63	350	462	659	78	194	931	0	3	47	50	708	144	591	1443
1961	49	45	329	423	522	99	228	849	0	1	43	44	571	145	600	1316
1962	34	56	351	441	508	103	306	917	0	2	49	51	542	161	706	1409
1963	52	46	359	457	553	112	268	933	0	1	35	36	605	159	662	1426
1964	89	85	502	676	591	79	253	923	0	3	43	46	680	167	798	1645
1965	115	67	656	838	636	70	295	1001	0	3	34	37	751	140	985	1876
1966	53	66	610	729	404	77	222	703	0	2	32	34	457	145	864	1466
1967	43	62	533	638	333	86	244	663	0	1	30	31	376	149	807	1332
1968	54	78	665	797	268	136	301	705	1	4	40	45	323	218	1006	1547
1969	40	85	740	865	230	190	288	708	0	4	49	53	270	279	1077	1626
1970	26	154	736	916	196	289	221	706	0	1	34	35	222	444	991	1657
1971	53	174	667	894	210	400	308	918	0	2	37	39	263	576	1012	1851
1972	37	227	817	1081	339	664	341	1344	0	0	24	24	376	891	1182	2449
1973	83	477	978	1538	407	834	483	1724	1	3	26	30	491	1314	1487	3292
1974	67	329	888	1284	487	1051	455	1993	2	0	14	16	556	1380	1357	3293
1975	62	397	797	1256	573	1202	421	2196	0	4	25	29	635	1603	1243	3481
1976	112	897	920	1929	399	1710	559	2668	1	3	31	35	512	2610	1510	4632
1977	146	892	1037	2075	459	1692	477	2628	2	1	23	26	607	2585	1537	4729
1978	157	816	1087	2060	561	1861	571	2993	1	3	12	16	719	2680	1670	5069
1979	164	628	953	1745	718	1927	655	3300	0	4	10	14	882	2559	1618	5059
1980	196	877	1090	2163	913	2277	831	4021	0	0	10	10	1109	3154	1931	6194
1981	193	588	1169	1950	688	1608	749	3045	0	0	12	12	881	2196	1930	5007
1982	240	327	923	1490	784	1501	704	2989	0	2	12	14	1024	1830	1639	4493
1983	212	162	724	1098	1106	601	765	2472	1	0	3	4	1319	763	1492	3574
1984	317	244	1012	1573	1388	728	1198	3314	16	3	26	45	1721	975	2236	4932
1985	390	219	1229	1838	1559	1303	1756	4618	10	2	77	89	1959	1524	3062	6545
1986	222	185	863	1270	912	466	816	2194	7	3	36	46	1141	654	1715	3510
1987	304	221	1018	1543	1155	401	1061	2617	3	4	19	26	1462	626	2098	4186
1988	278	303	1273	1854	1060	619	1480	3159	7	9	75	91	1345	931	2828	5104
1989	136	130	1430	1696	477	280	717	1474	1	2	32	35	614	412	2179	3205
1990	7	6	178	191	9	7	136	152	0	0	2	2	16	13	316	345
Total	4440	9419	29467	43326	24555	23093	19687	67355	59	132	1536	1727	29054	32644	50690	112388

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD006

Table 3.24

Cumulative Drilling Statistics
Sweet - 0 to 999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	16	46	1153	1215	284	170	808	1262	1	36	204	241	301	252	2165	2718
1951	26	63	1218	1307	353	188	842	1383	1	39	211	251	380	290	2271	2941
1952	50	88	1322	1460	533	220	919	1672	1	39	217	257	584	347	2458	3389
1953	72	107	1434	1613	633	258	989	1880	1	39	227	267	706	404	2650	3760
1954	87	124	1525	1736	687	303	1040	2030	1	41	237	279	775	468	2802	4045
1955	89	141	1581	1811	766	335	1081	2182	2	41	243	286	857	517	2905	4279
1956	96	159	1638	1893	849	352	1116	2317	2	42	273	317	947	553	3027	4527
1957	105	181	1740	2026	926	366	1145	2437	2	44	340	386	1033	591	3225	4849
1958	112	202	1832	2146	1007	417	1184	2608	2	48	528	578	1121	667	3544	5332
1959	115	227	1919	2261	1048	497	1208	2753	2	54	591	647	1165	778	3718	5661
1960	122	253	2002	2377	1074	541	1226	2841	2	57	637	696	1198	851	3865	5914
1961	123	276	2061	2460	1093	595	1254	2942	2	58	680	740	1218	929	3995	6142
1962	129	293	2123	2545	1137	648	1296	3081	2	60	728	790	1268	1001	4147	6416
1963	138	310	2203	2651	1173	734	1347	3254	2	61	763	826	1313	1105	4313	6731
1964	148	340	2310	2798	1234	775	1387	3396	2	64	806	872	1384	1179	4503	7066
1965	175	372	2540	3087	1311	827	1466	3604	2	67	840	909	1488	1266	4846	7600
1966	194	408	2751	3353	1412	894	1555	3861	2	69	872	943	1608	1371	5178	8157
1967	207	431	2913	3551	1530	961	1674	4165	2	70	902	974	1739	1462	5489	8690
1968	220	468	3092	3780	1640	1070	1848	4558	2	74	941	1017	1862	1612	5881	9355
1969	232	509	3337	4078	1726	1230	1990	4946	2	78	990	1070	1960	1817	6317	10094
1970	235	602	3646	4483	1812	1489	2094	5395	2	79	1023	1104	2049	2170	6763	10982
1971	260	718	3913	4891	1915	1832	2228	5975	2	81	1051	1134	2177	2631	7192	12000
1972	269	861	4243	5373	2033	2424	2410	6867	2	81	1075	1158	2304	3366	7728	13398
1973	295	1199	4696	6190	2197	3186	2659	8042	3	82	1093	1178	2495	4467	8448	15410
1974	312	1417	5106	6835	2476	4158	2916	9550	4	82	1102	1188	2792	5657	9124	17573
1975	330	1699	5528	7557	2856	5260	3198	11314	4	85	1121	1210	3190	7044	9847	20081
1976	359	2371	6002	8732	3062	6833	3582	13477	5	86	1147	1238	3426	9290	10731	23447
1977	415	2958	6498	9871	3286	8395	3868	15549	7	87	1158	1252	3708	11440	11524	26672
1978	455	3412	6943	10810	3529	10081	4207	17817	8	87	1165	1260	3992	13580	12315	29887
1979	484	3699	7276	11459	3787	11796	4554	20137	8	91	1171	1270	4279	15586	13001	32866
1980	524	4127	7646	12297	4135	13743	5004	22882	8	91	1180	1279	4667	17961	13830	36458
1981	557	4428	8115	13100	4438	15157	5415	25010	8	91	1191	1290	5003	19676	14721	39400
1982	585	4584	8475	13644	4740	16495	5793	27028	8	93	1202	1303	5333	21172	15470	41975
1983	598	4646	8650	13894	5129	16951	6218	28298	8	93	1205	1306	5735	21690	16073	43498
1984	643	4742	8908	14293	5632	17541	6929	30102	12	94	1226	1332	6287	22377	17063	45727
1985	708	4825	9202	14735	6288	18695	8113	33096	15	94	1286	1395	7011	23614	18601	49226
1986	733	4897	9404	15034	6526	19026	8507	34059	16	94	1309	1419	7275	24017	19220	50512
1987	769	4962	9620	15351	6879	19232	9142	35253	17	94	1322	1433	7665	24288	20084	52037
1988	817	5085	9933	15835	7250	19661	10070	36981	18	98	1381	1497	8085	24844	21384	54313
1989	839	5141	10389	16369	7430	19873	10407	37710	18	98	1403	1519	8287	25112	22199	55598
1990	841	5144	10450	16435	7434	19879	10474	37787	18	98	1403	1519	8293	25121	22327	55741
Total	841	5144	10450	16435	7434	19879	10474	37787	18	98	1403	1519	8293	25121	22327	55741

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCUM001

Cumulative Drilling Statistics
Sweet - 1000 to 1999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	21	33	434	488	75	17	179	271	0	1	1	2	96	51	614	761
1951	36	55	639	730	178	23	249	450	0	1	1	2	214	79	889	1182
1952	57	79	880	1016	373	26	361	760	0	1	1	2	430	106	1242	1778
1953	73	101	1038	1212	595	33	456	1084	2	1	1	4	670	135	1495	2300
1954	94	116	1160	1370	946	41	524	1511	2	1	1	4	1042	158	1685	2885
1955	133	141	1275	1549	1699	60	625	2384	2	2	1	5	1834	203	1901	3938
1956	159	164	1445	1768	2642	85	739	3466	2	4	1	7	2803	253	2185	5241
1957	202	178	1618	1998	3139	98	791	4028	4	6	1	11	3345	282	2410	6037
1958	222	191	1779	2192	3685	117	914	4716	4	7	2	13	3911	315	2695	6921
1959	252	228	1955	2435	4155	136	1007	5298	4	7	2	13	4411	371	2964	7746
1960	269	256	2100	2625	4522	160	1114	5796	4	7	3	14	4795	423	3217	8435
1961	287	273	2257	2817	4752	193	1225	6170	4	7	3	14	5043	473	3485	9001
1962	302	300	2438	3040	5030	233	1397	6660	4	7	4	15	5336	540	3839	9715
1963	325	324	2599	3248	5306	252	1528	7086	4	7	4	15	5635	583	4131	10349
1964	370	367	2873	3610	5584	279	1675	7538	4	7	4	15	5958	653	4552	11163
1965	433	397	3153	3983	5951	296	1835	8082	4	7	4	15	6388	700	4992	12080
1966	454	420	3418	4292	6168	301	1936	8405	4	7	4	15	6626	728	5358	12712
1967	478	448	3698	4624	6331	316	2037	8684	4	7	4	15	6813	771	5739	13323
1968	514	485	4075	5074	6450	334	2136	8920	5	7	5	17	6969	826	6216	14011
1969	538	524	4449	5511	6553	348	2242	9143	5	7	5	17	7096	879	6696	14671
1970	558	577	4763	5898	6636	373	2323	9332	5	7	6	18	7199	957	7092	15248
1971	578	630	5048	6256	6724	423	2464	9611	5	7	15	27	7307	1060	7527	15894
1972	597	707	5410	6714	6907	487	2591	9985	5	7	15	27	7509	1201	8016	16726
1973	639	831	5797	7267	7086	546	2778	10410	5	9	23	37	7730	1386	8598	17714
1974	667	919	6142	7728	7227	618	2927	10772	6	9	27	42	7900	1546	9096	18542
1975	687	1015	6420	8122	7354	702	3026	11082	6	10	33	49	8047	1727	9479	19253
1976	735	1196	6752	8683	7488	824	3168	11480	6	12	38	56	8229	2032	9958	20219
1977	806	1442	7132	9380	7676	935	3336	11947	6	12	50	68	8488	2389	10518	21395
1978	887	1700	7599	10186	7910	1089	3511	12510	6	13	55	74	8803	2802	11165	22770
1979	961	1904	8030	10895	8225	1262	3766	13253	6	13	58	77	9192	3179	11854	24225
1980	1057	2203	8526	11786	8623	1534	4080	14237	6	13	59	78	9686	3750	12665	26101
1981	1167	2405	9023	12595	8921	1687	4356	14964	6	13	60	79	10094	4105	13439	27638
1982	1301	2521	9426	13248	9279	1817	4632	15728	6	13	61	80	10586	4351	14119	29056
1983	1415	2591	9834	13840	9821	1937	4929	16687	6	13	61	80	11242	4541	14824	30607
1984	1610	2702	10384	14696	10505	2042	5365	17912	13	14	65	92	12128	4758	15814	32700
1985	1851	2802	11079	15732	11186	2165	5847	19198	17	15	77	109	13054	4982	17003	35039
1986	2010	2886	11606	16502	11704	2265	6195	20164	20	18	86	124	13734	5169	17887	36790
1987	2213	3011	12209	17433	12347	2419	6541	21307	22	19	90	131	14582	5449	18840	38871
1988	2385	3140	12931	18456	12921	2553	7002	22476	26	23	101	150	15332	5716	20034	41082
1989	2479	3192	13646	19317	13167	2614	7301	23082	26	25	106	157	15672	5831	21053	42556
1990	2484	3195	13744	19423	13171	2615	7361	23147	26	25	108	159	15681	5835	21213	42729
Total	2484	3195	13744	19423	13171	2615	7361	23147	26	25	108	159	15681	5835	21213	42729

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCUM002

Cumulative Drilling Statistics
Sweet - 2000 to 2999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	1	0	81	82	2	1	18	21	0	0	0	0	3	1	99	103
1951	3	2	102	107	2	1	19	22	0	0	0	0	5	3	121	129
1952	5	7	141	153	2	2	23	27	0	0	0	0	7	9	164	180
1953	10	11	189	210	3	2	32	37	0	0	0	0	13	13	221	247
1954	23	13	242	278	6	2	43	51	0	0	0	0	29	15	285	329
1955	32	17	298	347	21	3	54	78	0	0	0	0	53	20	352	425
1956	47	21	352	420	43	3	61	107	0	0	0	0	90	24	413	527
1957	53	28	420	501	65	5	82	152	0	0	1	1	118	33	503	654
1958	65	35	491	591	99	5	100	204	0	1	1	2	164	41	592	797
1959	88	41	556	685	229	8	137	374	0	1	1	2	317	50	694	1061
1960	112	48	655	815	487	17	201	705	0	1	1	2	599	66	857	1522
1961	139	52	740	931	760	28	286	1074	0	1	1	2	899	81	1027	2007
1962	151	61	827	1039	945	38	370	1353	0	1	1	2	1096	100	1198	2394
1963	167	66	918	1151	1181	45	451	1677	0	1	1	2	1348	112	1370	2830
1964	199	74	1011	1284	1429	56	516	2001	0	1	1	2	1628	131	1528	3287
1965	224	78	1128	1430	1616	57	569	2242	0	1	1	2	1840	136	1698	3674
1966	235	84	1238	1557	1699	61	594	2354	0	1	1	2	1934	146	1833	3913
1967	241	92	1312	1645	1749	65	612	2426	0	1	1	2	1990	158	1925	4073
1968	245	94	1394	1733	1786	71	633	2490	0	1	1	2	2031	166	2028	4225
1969	248	98	1478	1824	1827	86	669	2582	0	1	1	2	2075	185	2148	4408
1970	251	104	1550	1905	1853	91	702	2646	0	1	1	2	2104	196	2253	4553
1971	259	107	1635	2001	1872	98	728	2698	0	1	1	2	2131	206	2364	4701
1972	266	111	1727	2104	1910	106	759	2775	0	1	1	2	2176	218	2487	4881
1973	280	123	1825	2228	1974	116	802	2892	0	1	1	2	2254	240	2628	5122
1974	301	139	1925	2365	2041	123	848	3012	0	1	2	3	2342	263	2775	5380
1975	323	155	1995	2473	2107	138	885	3130	0	1	2	3	2430	294	2882	5606
1976	354	186	2070	2610	2166	152	913	3231	0	1	2	3	2520	339	2985	5844
1977	371	225	2185	2781	2213	168	934	3315	0	1	2	3	2584	394	3121	6099
1978	394	308	2314	3016	2295	188	987	3470	0	3	2	5	2689	499	3303	6491
1979	442	407	2454	3303	2436	225	1038	3699	0	3	3	6	2878	635	3495	7008
1980	496	507	2622	3625	2602	281	1100	3983	0	3	3	6	3098	791	3725	7614
1981	541	565	2763	3869	2689	320	1161	4170	0	3	3	6	3230	888	3927	8045
1982	618	610	2876	4104	2812	349	1210	4371	0	3	3	6	3430	962	4089	8481
1983	698	633	2990	4321	2984	365	1246	4595	1	3	3	7	3683	1001	4239	8923
1984	772	665	3160	4597	3183	389	1292	4864	6	3	4	13	3961	1057	4456	9474
1985	850	696	3375	4921	3399	412	1372	5183	9	3	8	20	4258	1111	4755	10124
1986	886	721	3495	5102	3553	444	1438	5435	11	3	12	26	4450	1168	4945	10563
1987	950	746	3663	5359	3711	478	1514	5703	11	5	14	30	4672	1229	5191	11092
1988	1005	792	3863	5660	3820	526	1599	5945	12	5	19	36	4837	1323	5481	11641
1989	1024	811	4075	5910	3870	532	1676	6078	13	5	23	41	4907	1348	5774	12029
1990	1024	811	4091	5926	3871	532	1685	6088	13	5	23	41	4908	1348	5799	12055
Total	1024	811	4091	5926	3871	532	1685	6088	13	5	23	41	4908	1348	5799	12055

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCUM003

Cumulative Drilling Statistics
Sweet - 3000 to 3999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	2	11	13	0	1	10	11	0	0	0	0	0	3	21	24
1951	0	2	13	15	0	1	10	11	0	0	0	0	0	3	23	26
1952	0	3	17	20	0	1	10	11	0	0	0	0	0	4	27	31
1953	1	4	20	25	0	1	10	11	0	0	0	0	1	5	30	36
1954	1	6	31	38	0	1	10	11	0	0	0	0	1	7	41	49
1955	1	8	58	67	1	1	12	14	0	0	0	0	2	9	70	81
1956	1	9	74	84	1	1	13	15	0	0	0	0	2	10	87	99
1957	2	9	95	106	2	1	13	16	0	0	0	0	4	10	108	122
1958	4	13	115	132	8	1	19	28	0	0	0	0	12	14	134	160
1959	5	17	139	161	19	1	29	49	0	0	0	0	24	18	168	210
1960	6	19	157	182	27	2	33	62	0	0	0	0	33	21	190	244
1961	8	20	179	207	27	3	37	67	0	0	0	0	35	23	216	274
1962	9	23	198	230	28	3	42	73	0	0	0	0	37	26	240	303
1963	13	23	221	257	33	3	47	83	0	0	0	0	46	26	268	340
1964	15	26	242	283	37	3	48	88	0	0	0	0	52	29	290	371
1965	15	27	264	306	42	3	51	96	0	0	0	0	57	30	315	402
1966	17	28	285	330	45	4	58	107	0	0	0	0	62	32	343	437
1967	17	31	301	349	47	4	63	114	0	0	0	0	64	35	364	463
1968	18	33	328	379	49	7	70	126	0	0	0	0	67	40	398	505
1969	19	34	356	409	49	8	74	131	0	0	0	0	68	42	430	540
1970	19	34	380	433	49	8	77	134	0	0	0	0	68	42	457	567
1971	19	36	401	456	49	8	84	141	0	0	0	0	68	44	485	597
1972	21	37	426	484	49	8	85	142	0	0	0	0	70	45	511	626
1973	22	40	459	521	49	11	86	146	0	0	0	0	71	51	545	667
1974	23	45	484	552	49	11	89	149	0	0	0	0	72	56	573	701
1975	25	48	504	577	49	12	91	152	0	0	0	0	74	60	595	729
1976	29	58	540	627	49	13	96	158	0	0	0	0	78	71	636	785
1977	31	71	578	680	49	16	98	163	0	0	0	0	80	87	676	843
1978	44	86	612	742	51	16	102	169	0	0	0	0	95	102	714	911
1979	57	120	643	820	55	17	104	176	0	0	0	0	112	137	747	996
1980	62	161	681	904	56	19	107	182	0	0	0	0	118	180	788	1086
1981	67	182	724	973	56	21	108	185	0	0	0	0	123	203	832	1158
1982	68	188	760	1016	57	25	109	191	0	0	0	0	125	213	869	1207
1983	73	195	783	1051	60	34	116	210	0	0	0	0	133	229	899	1261
1984	76	199	809	1084	62	43	121	226	0	1	0	1	138	243	930	1311
1985	82	203	830	1115	68	46	131	245	0	1	1	2	150	250	962	1362
1986	84	205	840	1129	70	49	139	258	1	1	1	3	155	255	980	1390
1987	85	211	867	1163	71	56	142	269	1	2	1	4	157	269	1010	1436
1988	88	215	895	1198	77	64	148	289	2	3	1	6	167	282	1044	1493
1989	89	218	929	1236	78	65	152	295	2	3	1	6	169	286	1082	1537
1990	89	218	930	1237	78	65	152	295	2	3	1	6	169	286	1083	1538
Total	89	218	930	1237	78	65	152	295	2	3	1	6	169	286	1083	1538

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCUM004

Cumulative Drilling Statistics
Sweet - 4000 to 9999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
1951	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
1952	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
1953	0	0	1	1	0	0	1	1	0	0	0	0	0	0	2	2
1954	0	0	1	1	0	0	1	1	0	0	0	0	0	0	2	2
1955	0	0	2	2	0	0	1	1	0	0	0	0	0	0	3	3
1956	0	0	7	7	0	0	1	1	0	0	0	0	0	0	8	8
1957	0	0	9	9	0	0	1	1	0	0	0	0	0	0	10	10
1958	0	0	11	11	0	0	2	2	0	0	0	0	0	0	13	13
1959	0	0	14	14	0	0	3	3	0	0	0	0	0	0	17	17
1960	0	0	19	19	0	0	4	4	0	0	0	0	0	0	23	23
1961	1	0	25	26	0	0	4	4	0	0	0	0	1	0	29	30
1962	1	0	27	28	0	0	7	7	0	0	0	0	1	0	34	35
1963	1	0	31	32	0	0	7	7	0	0	0	0	1	0	38	39
1964	1	1	38	40	0	0	7	7	0	0	0	0	1	1	45	47
1965	1	1	45	47	0	0	7	7	0	0	0	0	1	1	52	54
1966	1	1	48	50	0	0	7	7	0	0	0	0	1	1	55	57
1967	1	1	49	51	0	0	8	8	0	0	0	0	1	1	57	59
1968	1	1	49	51	0	0	8	8	0	0	0	0	1	1	57	59
1969	1	1	58	60	0	0	8	8	0	0	0	0	1	1	66	68
1970	1	3	75	79	1	0	8	9	0	0	0	0	2	3	83	88
1971	1	3	84	88	1	0	8	9	0	0	0	0	2	3	92	97
1972	1	5	92	98	1	0	8	9	0	0	0	0	2	5	100	107
1973	1	5	99	105	1	0	11	12	0	0	0	0	2	5	110	117
1974	1	7	107	115	1	0	11	12	0	0	0	0	2	7	118	127
1975	1	7	114	122	1	0	12	13	0	0	0	0	2	7	126	135
1976	1	10	117	128	1	0	12	13	0	0	0	0	2	10	129	141
1977	1	17	125	143	1	0	12	13	0	0	0	0	2	17	137	156
1978	1	23	137	161	1	1	12	14	0	0	0	0	2	24	149	175
1979	1	27	155	183	1	2	12	15	0	0	0	0	2	29	167	198
1980	2	36	173	211	1	2	14	17	0	0	0	0	3	38	187	228
1981	2	42	192	236	1	2	14	17	0	0	0	0	3	44	206	253
1982	2	46	203	251	1	2	14	17	0	0	0	0	3	48	217	268
1983	2	46	207	255	1	2	14	17	0	0	0	0	3	48	221	272
1984	2	47	215	264	1	2	14	17	0	0	0	0	3	49	229	281
1985	2	48	219	269	1	2	14	17	0	1	0	1	3	51	233	287
1986	2	50	223	275	1	2	14	17	0	1	0	1	3	53	237	293
1987	2	50	227	279	1	2	15	18	0	1	0	1	3	53	242	298
1988	2	51	237	290	1	2	15	18	0	1	0	1	3	54	252	309
1989	2	51	250	303	1	2	15	18	0	1	1	2	3	54	266	323
1990	2	51	252	305	1	2	15	18	0	1	1	2	3	54	268	325
Total	2	51	252	305	1	2	15	18	0	1	1	2	3	54	268	325

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCUM005

Cumulative Drilling Statistics
Sweet - Total of All Depths

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	38	81	1679	1798	361	189	1016	1566	1	37	205	243	400	307	2900	3607
1951	65	122	1972	2159	533	213	1121	1867	1	40	212	253	599	375	3305	4279
1952	112	177	2360	2649	908	249	1314	2471	1	40	218	259	1021	466	3892	5379
1953	156	223	2682	3061	1231	294	1488	3013	3	40	228	271	1390	557	4398	6345
1954	205	259	2959	3423	1639	347	1618	3604	3	42	238	283	1847	648	4815	7310
1955	255	307	3214	3776	2487	399	1773	4659	4	43	244	291	2746	749	5231	8726
1956	303	353	3516	4172	3535	441	1930	5906	4	46	274	324	3842	840	5720	10402
1957	362	396	3882	4640	4132	470	2032	6634	6	50	342	398	4500	916	6256	11672
1958	403	441	4228	5072	4799	540	2219	7558	6	56	531	593	5208	1037	6978	13223
1959	460	513	4583	5556	5451	642	2384	8477	6	62	594	662	5917	1217	7561	14695
1960	509	576	4933	6018	6110	720	2578	9408	6	65	641	712	6625	1361	8152	16138
1961	558	621	5262	6441	6632	819	2806	10257	6	66	684	756	7196	1506	8752	17454
1962	592	677	5613	6882	7140	922	3112	11174	6	68	733	807	7738	1667	9458	18863
1963	644	723	5972	7339	7693	1034	3380	12107	6	69	768	843	8343	1826	10120	20289
1964	733	808	6474	8015	8284	1113	3633	13030	6	72	811	889	9023	1993	10918	21934
1965	848	875	7130	8853	8920	1183	3928	14031	6	75	845	926	9774	2133	11903	23810
1966	901	941	7740	9582	9324	1260	4150	14734	6	77	877	960	10231	2278	12767	25276
1967	944	1003	8273	10220	9657	1346	4394	15397	6	78	907	991	10607	2427	13574	26608
1968	998	1081	8938	11017	9925	1482	4695	16102	7	82	947	1036	10930	2645	14580	28155
1969	1038	1166	9678	11882	10155	1672	4983	16810	7	86	996	1089	11200	2924	15657	29781
1970	1064	1320	10414	12798	10351	1961	5204	17516	7	87	1030	1124	11422	3368	16648	31438
1971	1117	1494	11081	13692	10561	2361	5512	18434	7	89	1067	1163	11685	3944	17660	33289
1972	1154	1721	11898	14773	10900	3025	5853	19778	7	89	1091	1187	12061	4835	18842	35738
1973	1237	2198	12876	16311	11307	3859	6336	21502	8	92	1117	1217	12552	6149	20329	39030
1974	1304	2527	13764	17595	11794	4910	6791	23495	10	92	1131	1233	13108	7529	21686	42323
1975	1366	2924	14561	18851	12367	6112	7212	25691	10	96	1156	1262	13743	9132	22929	45804
1976	1478	3821	15481	20780	12766	7822	7771	28359	11	99	1187	1297	14255	11742	24439	50436
1977	1624	4713	16518	22855	13225	9514	8248	30987	13	100	1210	1323	14862	14327	25976	55165
1978	1781	5529	17605	24915	13786	11375	8819	33980	14	103	1222	1339	15581	17007	27646	60234
1979	1945	6157	18558	26660	14504	13302	9474	37280	14	107	1232	1353	16463	19566	29264	65293
1980	2141	7034	19648	28823	15417	15579	10305	41301	14	107	1242	1363	17572	22720	31195	71487
1981	2334	7622	20817	30773	16105	17187	11054	44346	14	107	1254	1375	18453	24916	33125	76494
1982	2574	7949	21740	32263	16889	18688	11758	47335	14	109	1266	1389	19477	26746	34764	80987
1983	2786	8111	22464	33361	17995	19289	12523	49807	15	109	1269	1393	20796	27509	36256	84561
1984	3103	8355	23476	34934	19383	20017	13721	53121	31	112	1295	1438	22517	28484	38492	89493
1985	3493	8574	24705	36772	20942	21320	15477	57739	41	114	1372	1527	24476	30008	41554	96038
1986	3715	8759	25568	38042	21854	21786	16293	59933	48	117	1408	1573	25617	30662	43269	99548
1987	4019	8980	26586	39585	23009	22187	17354	62550	51	121	1427	1599	27079	31288	45367	103734
1988	4297	9283	27859	41439	24069	22806	18834	65709	58	130	1502	1690	28424	32219	48195	108838
1989	4433	9413	29289	43135	24546	23086	19551	67183	59	132	1534	1725	29038	32631	50374	112043
1990	4440	9419	29467	43326	24555	23093	19687	67335	59	132	1536	1727	29054	32644	50690	112388
Total	4440	9419	29467	43326	24555	23093	19687	67335	59	132	1536	1727	29054	32644	50690	112388

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCUM006

Table 3.25

Historical Drilling Statistics
Sour - 0 to 999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	8	17	6	31	569	69	23	661	0	1	73	74	577	87	102	766
1951	1	2	0	3	93	11	1	105	0	0	12	12	94	13	13	120
1952	1	8	0	9	12	16	0	28	0	0	10	10	13	24	10	47
1953	0	1	2	3	1	6	1	8	0	0	5	5	1	7	8	16
1954	1	1	2	4	2	4	3	9	0	0	6	6	3	5	11	19
1955	0	4	1	5	1	3	2	6	0	0	5	5	1	7	8	16
1956	0	1	3	4	3	5	1	9	0	0	6	6	3	6	10	19
1957	0	0	2	2	2	1	3	6	0	0	2	2	2	1	7	10
1958	0	2	5	7	3	4	0	7	0	0	3	3	3	6	8	17
1959	0	3	2	5	2	4	0	6	0	0	7	7	2	7	9	18
1960	0	3	0	3	2	3	2	7	0	0	9	9	2	6	11	19
1961	0	2	0	2	2	4	1	7	0	0	16	16	2	6	17	25
1962	0	2	1	3	0	4	1	5	0	0	5	5	0	6	7	13
1963	0	0	2	2	4	1	0	5	0	0	4	4	4	1	6	11
1964	3	2	2	7	10	5	1	16	0	0	5	5	13	7	8	28
1965	3	8	7	18	5	1	3	9	0	1	3	4	8	10	13	31
1966	3	4	1	8	8	0	3	11	0	0	11	11	11	4	15	30
1967	1	4	3	8	8	1	3	12	0	1	22	23	9	6	28	43
1968	3	7	4	14	18	8	4	30	0	0	32	32	21	15	40	76
1969	5	9	1	15	6	8	4	18	0	0	5	5	11	17	10	38
1970	0	9	3	12	3	12	5	20	0	0	3	3	3	21	11	35
1971	2	10	6	18	5	18	3	26	0	0	5	5	7	28	14	49
1972	5	22	3	30	14	13	3	30	0	2	7	9	19	37	13	69
1973	5	29	10	44	10	19	4	33	0	0	15	15	15	48	29	92
1974	8	26	10	44	14	31	9	54	0	0	3	3	22	57	22	101
1975	7	49	9	65	4	44	2	50	0	0	9	9	11	93	20	124
1976	4	106	14	124	11	67	8	86	0	1	5	6	15	174	27	216
1977	9	85	13	107	17	50	13	80	0	0	8	8	26	135	34	195
1978	6	65	13	84	22	48	12	82	0	0	3	3	28	113	28	169
1979	13	51	9	73	34	71	11	116	0	0	4	4	47	122	24	193
1980	11	59	16	86	27	55	16	98	0	1	4	5	38	115	36	189
1981	18	58	22	98	27	51	23	101	0	0	1	1	45	109	46	200
1982	6	25	16	47	23	22	20	65	0	1	3	4	29	48	39	116
1983	16	17	13	46	44	12	9	65	0	0	0	0	60	29	22	111
1984	19	23	16	58	68	24	21	113	1	0	12	13	88	47	49	184
1985	14	14	12	40	59	34	17	110	0	0	4	4	73	48	33	154
1986	5	22	26	53	63	32	16	111	0	0	0	0	68	54	42	164
1987	15	28	8	51	121	36	18	175	0	0	2	2	136	64	28	228
1988	26	51	30	107	233	53	67	353	0	0	0	0	259	104	97	460
1989	32	37	31	100	131	37	28	196	0	0	1	1	163	74	60	297
1990	2	0	0	2	0	0	0	0	0	0	0	0	2	0	0	2
Total	252	866	324	1442	1681	887	361	2929	1	8	330	339	1934	1761	1015	4710

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD$001

Historical Drilling Statistics
Sour - 1000 to 1999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	24	14	15	53	764	112	39	915	0	0	0	0	788	126	54	968
1951	24	16	5	45	408	6	14	428	2	0	0	2	434	22	19	475
1952	23	12	4	39	397	12	28	437	3	0	0	3	423	24	32	479
1953	15	8	5	28	252	7	26	285	1	0	0	1	268	15	31	314
1954	7	6	3	16	101	4	3	108	0	0	0	0	108	10	6	124
1955	12	5	4	21	74	7	10	91	0	0	0	0	86	12	14	112
1956	15	9	2	26	50	7	5	62	0	0	0	0	65	16	7	88
1957	7	13	5	25	37	8	1	46	1	2	2	5	45	23	8	76
1958	6	10	3	19	31	8	4	43	0	2	1	3	37	20	8	65
1959	5	12	3	20	11	12	5	28	0	0	0	0	16	24	8	48
1960	7	13	6	26	14	11	3	28	0	0	0	0	21	24	9	54
1961	11	11	6	28	28	19	4	51	0	0	0	0	39	30	10	79
1962	3	4	5	12	38	14	5	57	0	0	0	0	41	18	10	69
1963	8	11	3	22	46	6	4	56	0	0	0	0	54	17	7	78
1964	7	13	2	22	41	10	6	57	0	0	0	0	48	23	8	79
1965	10	11	11	32	31	8	7	46	0	0	0	0	41	19	18	78
1966	19	14	11	44	59	7	2	68	0	0	0	0	78	21	13	112
1967	93	26	20	139	77	15	15	107	0	0	0	0	170	41	35	246
1968	108	32	39	179	63	18	6	87	0	0	0	0	171	50	45	266
1969	88	12	26	126	17	11	6	34	0	0	1	1	105	23	33	161
1970	29	16	18	63	19	6	5	30	0	0	0	0	48	22	23	93
1971	43	22	15	80	11	8	7	26	0	0	0	0	54	30	22	106
1972	19	15	18	52	39	9	8	56	0	0	0	0	58	24	26	108
1973	19	24	10	53	26	10	12	48	0	1	0	1	45	35	22	102
1974	21	17	4	42	25	11	9	45	0	0	2	2	46	28	15	89
1975	12	22	10	44	18	19	10	47	0	1	1	2	30	42	21	93
1976	16	30	6	52	43	32	9	84	0	0	2	2	59	62	17	138
1977	24	41	14	79	27	33	12	72	0	0	0	0	51	74	26	151
1978	20	61	23	104	54	42	8	104	0	0	1	1	74	103	32	209
1979	35	67	22	124	75	48	32	155	0	0	2	2	110	115	56	281
1980	54	91	34	179	69	71	27	167	0	0	1	1	123	162	62	347
1981	51	61	41	153	62	42	31	135	0	0	3	3	113	103	75	291
1982	90	45	42	177	91	29	24	144	0	0	7	7	181	74	73	328
1983	101	33	46	180	149	32	30	211	0	0	3	3	250	65	79	394
1984	109	47	61	217	149	31	17	197	0	0	0	0	258	78	78	414
1985	136	65	67	268	161	48	37	246	1	0	0	1	298	113	104	515
1986	85	40	37	162	129	45	21	195	0	0	2	2	214	85	60	359
1987	93	60	53	206	123	33	29	185	0	0	0	0	216	93	82	391
1988	72	83	57	212	243	59	44	346	0	0	0	0	315	142	101	558
1989	65	47	48	160	110	24	18	152	0	0	0	0	175	71	66	312
1990	1	0	0	1	2	0	0	2	0	0	0	0	3	0	0	3
Total	1587	1139	804	3530	4164	934	583	5681	8	6	28	42	5759	2079	1415	9253

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD$002

Historical Drilling Statistics
Sour - 2000 to 2999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	1	2	2	5	269	28	20	317	0	0	0	0	270	30	22	322
1951	1	3	1	5	8	1	0	9	0	0	0	0	9	4	1	14
1952	7	3	3	13	40	2	3	45	0	0	0	0	47	5	6	58
1953	14	5	2	21	95	11	2	108	0	0	0	0	109	16	4	129
1954	15	4	1	20	59	5	6	70	0	0	0	0	74	9	7	90
1955	7	3	4	14	60	5	4	69	3	0	0	3	70	8	8	86
1956	16	12	3	31	103	4	5	112	0	0	0	0	119	16	8	143
1957	17	7	6	30	94	5	11	110	1	0	1	2	112	12	18	142
1958	8	9	6	23	168	11	7	186	0	0	0	0	176	20	13	209
1959	10	4	4	18	72	10	9	91	0	0	0	0	82	14	13	109
1960	11	8	8	27	105	15	15	135	0	0	0	0	116	23	23	162
1961	11	22	6	39	103	21	19	143	0	0	0	0	114	43	25	182
1962	7	10	7	24	63	22	13	98	0	1	0	1	70	33	20	123
1963	9	10	2	21	139	15	15	169	0	0	0	0	148	25	17	190
1964	8	3	4	15	98	11	14	123	0	0	0	0	106	14	18	138
1965	14	9	10	33	25	19	5	49	0	0	0	0	39	28	15	82
1966	19	11	10	40	26	24	10	60	0	0	0	0	45	35	20	100
1967	8	13	4	25	12	36	8	56	0	0	0	0	20	49	12	81
1968	10	5	10	25	5	14	4	23	0	0	0	0	15	19	14	48
1969	3	3	13	19	17	23	8	48	0	0	0	0	20	26	21	67
1970	6	6	5	17	18	21	4	43	0	0	0	0	24	27	9	60
1971	2	3	9	14	17	8	6	31	0	0	0	0	19	11	15	45
1972	2	13	12	27	24	13	5	42	0	0	0	0	26	26	17	69
1973	9	15	6	30	17	15	5	37	0	0	0	0	26	30	11	67
1974	4	11	8	23	18	10	3	31	0	0	1	1	22	21	12	55
1975	4	8	4	16	13	25	1	39	0	0	0	0	17	33	5	55
1976	2	18	6	26	13	24	7	44	0	0	0	0	15	42	13	70
1977	11	27	8	46	12	19	5	36	0	0	0	0	23	46	13	82
1978	33	41	21	95	19	26	8	53	0	0	1	1	52	67	30	149
1979	34	53	24	111	42	41	21	104	1	0	0	1	77	94	45	216
1980	27	62	50	139	39	41	8	88	0	0	0	0	66	103	58	227
1981	25	47	24	96	16	29	15	60	0	0	0	0	41	76	39	156
1982	27	19	19	65	41	22	13	76	0	0	1	1	68	41	33	142
1983	22	15	21	58	54	9	13	76	0	0	0	0	76	24	34	134
1984	42	27	17	86	74	14	14	102	0	0	0	0	116	41	31	188
1985	55	30	19	104	72	28	30	130	0	0	0	0	127	58	49	234
1986	11	25	19	55	55	19	21	95	0	0	0	0	66	44	40	150
1987	29	18	17	64	55	14	8	77	0	0	0	0	84	32	25	141
1988	24	33	27	84	35	20	9	64	0	0	0	0	59	53	36	148
1989	14	18	18	50	10	11	3	24	1	0	0	1	25	29	21	75
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	579	635	440	1654	2205	691	377	3273	6	1	4	11	2790	1327	821	4938

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD$003

Historical Drilling Statistics
Sour - 3000 to 3999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	2	2	4	1	1	0	2	0	0	0	0	1	3	2	6
1951	0	1	2	3	0	3	0	3	0	0	0	0	0	4	2	6
1952	0	1	0	1	0	0	1	1	0	0	0	0	0	1	1	2
1953	0	1	0	1	0	3	0	3	0	0	0	0	0	4	0	4
1954	2	2	1	5	1	0	0	1	0	0	0	0	3	2	1	6
1955	4	2	2	8	0	0	1	1	0	0	0	0	4	2	3	9
1956	2	2	2	6	0	1	0	1	0	0	0	0	2	3	2	7
1957	1	6	2	9	0	2	0	2	0	0	0	0	1	8	2	11
1958	1	6	2	9	11	0	4	15	0	0	0	0	12	6	6	24
1959	2	5	4	11	9	2	4	15	0	0	0	0	11	7	8	26
1960	2	5	2	9	12	9	1	22	0	0	0	0	14	14	3	31
1961	2	6	2	10	7	12	1	20	0	0	0	0	9	18	3	30
1962	2	2	2	6	1	5	2	8	0	0	0	0	3	7	4	14
1963	3	6	2	11	1	5	3	9	0	0	0	0	4	11	5	20
1964	1	7	7	15	0	1	3	4	0	0	0	0	1	8	10	19
1965	3	7	5	15	0	5	2	7	0	0	0	0	3	12	7	22
1966	1	4	1	6	1	8	0	9	0	0	0	0	2	12	1	15
1967	2	6	1	9	3	11	3	17	0	0	0	0	5	17	4	26
1968	1	14	5	20	1	40	4	45	0	0	0	0	2	54	9	65
1969	1	1	6	8	1	31	4	36	0	0	0	0	2	32	10	44
1970	0	2	3	5	0	27	5	32	0	0	0	0	0	29	8	37
1971	0	1	4	5	0	13	3	16	0	0	0	0	0	14	7	21
1972	1	5	12	18	0	4	0	4	0	0	0	0	1	9	12	22
1973	2	6	3	11	1	7	1	9	0	0	0	0	3	13	4	20
1974	1	3	7	11	0	15	3	18	0	0	0	0	1	18	10	29
1975	1	7	6	14	0	19	1	20	0	0	0	0	1	26	7	34
1976	3	18	8	29	1	11	2	14	0	0	0	0	4	29	10	43
1977	5	26	20	51	3	8	3	14	0	0	0	0	8	34	23	65
1978	8	36	7	51	1	5	2	8	0	0	0	0	9	41	9	59
1979	8	35	4	47	3	5	5	13	0	0	0	0	11	40	9	60
1980	10	54	16	80	6	12	4	22	0	0	0	0	16	66	20	102
1981	8	36	17	61	1	9	9	19	0	0	0	0	9	45	26	80
1982	2	7	11	20	3	7	1	11	0	0	0	0	5	14	12	31
1983	4	4	8	16	3	6	2	11	0	0	0	0	7	10	10	27
1984	2	8	4	14	1	7	1	9	0	0	0	0	3	15	5	23
1985	4	5	10	19	2	13	1	16	0	0	0	0	6	18	11	35
1986	12	11	6	29	5	4	2	11	0	0	0	0	17	15	8	40
1987	8	12	13	33	7	8	3	18	0	0	0	0	15	20	16	51
1988	2	11	7	20	3	9	2	14	0	0	0	0	5	20	9	34
1989	1	0	1	2	1	1	2	4	0	0	0	0	2	1	3	6
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	112	373	217	702	90	329	85	504	0	0	0	0	202	702	302	1206

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD$004

Historical Drilling Statistics
Sour - 4000 to 4999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1
1957	0	1	2	3	0	0	1	1	0	0	0	0	0	1	3	4
1958	0	4	1	5	0	0	0	0	0	0	0	0	0	4	1	5
1959	1	2	2	5	0	1	2	3	0	0	0	0	1	3	4	8
1960	1	2	2	5	0	3	3	6	0	0	0	0	1	5	5	11
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	2
1963	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
1964	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1
1965	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1
1966	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
1967	0	1	0	1	0	1	0	1	0	0	0	0	0	2	0	2
1968	0	4	1	5	0	0	0	0	0	0	0	0	0	4	1	5
1969	2	3	6	11	0	4	1	5	0	0	0	0	2	7	7	16
1970	0	4	11	15	0	1	4	5	0	0	0	0	0	5	15	20
1971	1	2	5	8	0	1	1	2	0	0	0	0	1	3	6	10
1972	0	2	5	7	0	1	1	2	0	0	0	0	0	3	6	9
1973	0	3	3	6	0	1	1	2	0	0	0	0	0	4	4	8
1974	1	2	2	5	0	1	1	2	0	0	0	0	1	3	3	7
1975	0	0	6	6	0	1	0	1	0	0	0	0	0	1	6	7
1976	0	11	7	18	0	2	0	2	0	0	0	0	0	13	7	20
1977	0	18	7	25	0	3	1	4	0	0	0	0	0	21	8	29
1978	0	16	8	24	0	2	1	3	0	0	0	0	0	18	9	27
1979	1	19	8	28	0	1	1	2	0	0	0	0	1	20	9	30
1980	0	19	9	28	0	0	0	0	0	0	0	0	0	19	9	28
1981	0	13	4	17	0	1	2	3	0	0	0	0	0	14	6	20
1982	1	2	2	5	0	0	1	1	0	0	0	0	1	2	3	6
1983	1	0	1	2	0	2	0	2	0	0	0	0	1	2	1	4
1984	0	1	4	5	0	0	0	0	0	0	0	0	0	1	4	5
1985	0	1	3	4	0	3	0	3	0	0	0	0	0	4	3	7
1986	0	2	2	4	0	1	2	3	0	0	0	0	0	3	4	7
1987	0	1	3	4	0	2	2	4	0	0	0	0	0	3	5	8
1988	0	4	4	8	0	3	2	5	0	0	0	0	0	7	6	13
1989	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	9	140	113	262	0	36	28	64	0	0	0	0	9	176	141	326

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD$005

Historical Drilling Statistics
Sour - Total of All Depths

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	33	35	25	93	1603	211	82	1896	0	1	73	74	1636	247	180	2063
1951	26	22	8	56	509	21	15	545	2	0	12	14	537	43	35	615
1952	31	24	7	62	449	30	32	511	3	0	10	13	483	54	49	586
1953	29	15	10	54	348	27	29	404	1	0	5	6	378	42	44	464
1954	25	13	7	45	163	13	12	188	0	0	6	6	188	26	25	239
1955	23	14	11	48	135	15	17	167	3	0	5	8	161	29	33	223
1956	33	25	10	68	156	17	11	184	0	0	6	6	189	42	27	258
1957	25	27	17	69	133	16	16	165	2	2	5	9	160	45	38	243
1958	15	31	17	63	213	23	15	251	0	2	4	6	228	56	36	320
1959	18	26	15	59	94	29	20	143	0	0	7	7	112	55	42	209
1960	21	31	18	70	133	41	24	198	0	0	9	9	154	72	51	277
1961	24	41	14	79	140	56	25	221	0	0	16	16	164	97	55	316
1962	12	18	17	47	102	45	21	168	0	1	5	6	114	64	43	221
1963	20	27	10	57	190	27	22	239	0	0	4	4	210	54	36	300
1964	19	26	15	60	149	27	24	200	0	0	5	5	168	53	44	265
1965	30	36	33	99	61	33	17	111	0	1	3	4	91	70	53	214
1966	42	33	24	99	94	39	15	148	0	0	11	11	136	72	50	258
1967	104	50	28	182	100	64	29	193	0	1	22	23	204	115	79	398
1968	122	62	59	243	87	80	18	185	0	0	32	32	209	142	109	460
1969	99	28	52	179	41	77	23	141	0	0	6	6	140	105	81	326
1970	35	37	40	112	40	67	23	130	0	0	3	3	75	104	66	245
1971	48	38	39	125	33	48	20	101	0	0	5	5	81	86	64	231
1972	27	57	50	134	77	40	17	134	0	2	7	9	104	99	74	277
1973	35	77	32	144	54	52	23	129	0	1	15	16	89	130	70	289
1974	35	59	31	125	57	68	25	150	0	0	6	6	92	127	62	281
1975	24	86	35	145	35	108	14	157	0	1	10	11	59	195	59	313
1976	25	183	41	249	68	136	26	230	0	1	7	8	93	320	74	487
1977	49	197	62	308	59	113	34	206	0	0	8	8	108	310	104	522
1978	67	219	72	358	96	123	31	250	0	0	5	5	163	342	108	613
1979	91	225	67	383	154	166	70	390	1	0	6	7	246	391	143	780
1980	102	285	125	512	141	179	55	375	0	1	5	6	243	465	185	893
1981	102	215	108	425	106	132	80	318	0	0	4	4	208	347	192	747
1982	126	98	90	314	158	80	59	297	0	1	11	12	284	179	160	623
1983	144	69	89	302	250	61	54	365	0	0	3	3	394	130	146	670
1984	172	106	102	380	292	76	53	421	1	0	12	13	465	182	167	814
1985	209	115	111	435	294	126	85	505	1	0	4	5	504	241	200	945
1986	113	100	90	303	252	101	62	415	0	0	2	2	365	201	154	720
1987	145	119	94	358	306	93	60	459	0	0	2	2	451	212	156	819
1988	124	182	125	431	514	144	124	782	0	0	0	0	638	326	249	1213
1989	112	102	98	312	252	73	52	377	1	0	1	2	365	175	151	691
1990	3	0	0	3	2	0	0	2	0	0	0	0	5	0	0	5
Total	2539	3153	1898	7590	8140	2877	1434	12451	15	15	362	392	10694	6045	3694	20433

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCD$006

Table 3.26

Cumulative Drilling Statistics
Sour - 0 to 999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	8	17	6	31	569	69	23	661	0	1	73	74	577	87	102	766
1951	9	19	6	34	662	80	24	766	0	1	85	86	671	100	115	886
1952	10	27	6	43	674	96	24	794	0	1	95	96	684	124	125	933
1953	10	28	8	46	675	102	25	802	0	1	100	101	685	131	133	949
1954	11	29	10	50	677	106	28	811	0	1	106	107	688	136	144	968
1955	11	33	11	55	678	109	30	817	0	1	111	112	689	143	152	984
1956	11	34	14	59	681	114	31	826	0	1	117	118	692	149	162	1003
1957	11	34	16	61	683	115	34	832	0	1	119	120	694	150	169	1013
1958	11	36	21	68	686	119	34	839	0	1	122	123	697	156	177	1030
1959	11	39	23	73	688	123	34	845	0	1	129	130	699	163	186	1048
1960	11	42	23	76	690	126	36	852	0	1	138	139	701	169	197	1067
1961	11	44	23	78	692	130	37	859	0	1	154	155	703	175	214	1092
1962	11	46	24	81	692	134	38	864	0	1	159	160	703	181	221	1105
1963	11	46	26	83	696	135	38	869	0	1	163	164	707	182	227	1116
1964	14	48	28	90	706	140	39	885	0	1	168	169	720	189	235	1144
1965	17	56	35	108	711	141	42	894	0	2	171	173	728	199	248	1175
1966	20	60	36	116	719	141	45	905	0	2	182	184	739	203	263	1205
1967	21	64	39	124	727	142	48	917	0	3	204	207	748	209	291	1248
1968	24	71	43	138	745	150	52	947	0	3	236	239	769	224	331	1324
1969	29	80	44	153	751	158	56	965	0	3	241	244	780	241	341	1362
1970	29	89	47	165	754	170	61	985	0	3	244	247	783	262	352	1397
1971	31	99	53	183	759	188	64	1011	0	3	249	252	790	290	366	1446
1972	36	121	56	213	773	201	67	1041	0	5	256	261	809	327	379	1515
1973	41	150	66	257	783	220	71	1074	0	5	271	276	824	375	408	1607
1974	49	176	76	301	797	251	80	1128	0	5	274	279	846	432	430	1708
1975	56	225	85	366	801	295	82	1178	0	5	283	288	857	525	450	1832
1976	60	331	99	490	812	362	90	1264	0	6	288	294	872	699	477	2048
1977	69	416	112	597	829	412	103	1344	0	6	296	302	898	834	511	2243
1978	75	481	125	681	851	460	115	1426	0	6	299	305	926	947	539	2412
1979	88	532	134	754	885	531	126	1542	0	6	303	309	973	1069	563	2605
1980	99	591	150	840	912	586	142	1640	0	7	307	314	1011	1184	599	2794
1981	117	649	172	938	939	637	165	1741	0	7	308	315	1056	1293	645	2994
1982	123	674	188	985	962	659	185	1806	0	8	311	319	1085	1341	684	3110
1983	139	691	201	1031	1006	671	194	1871	0	8	311	319	1145	1370	706	3221
1984	158	714	217	1089	1074	695	215	1984	1	8	323	332	1233	1417	755	3405
1985	172	728	229	1129	1133	729	232	2094	1	8	327	336	1306	1465	788	3559
1986	177	750	255	1182	1196	761	248	2205	1	8	327	336	1374	1519	830	3723
1987	192	778	263	1233	1317	797	266	2380	1	8	329	338	1510	1583	858	3951
1988	218	829	293	1340	1550	850	333	2733	1	8	329	338	1769	1687	955	4411
1989	250	866	324	1440	1681	887	361	2929	1	8	330	339	1932	1761	1015	4708
1990	252	866	324	1442	1681	887	361	2929	1	8	330	339	1934	1761	1015	4710
Total	252	866	324	1442	1681	887	361	2929	1	8	330	339	1934	1761	1015	4710

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SOCUM001

Cumulative Drilling Statistics
Sour - 1000 to 1999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	24	14	15	53	764	112	39	915	0	0	0	0	788	126	54	968
1951	48	30	20	98	1172	118	53	1343	2	0	0	2	1222	148	73	1443
1952	71	42	24	137	1569	130	81	1780	5	0	0	5	1645	172	105	1922
1953	86	50	29	165	1821	137	107	2065	6	0	0	6	1913	187	136	2236
1954	93	56	32	181	1922	141	110	2173	6	0	0	6	2021	197	142	2360
1955	105	61	36	202	1996	148	120	2264	6	0	0	6	2107	209	156	2472
1956	120	70	38	228	2046	155	125	2326	6	0	0	6	2172	225	163	2560
1957	127	83	43	253	2083	163	126	2372	7	2	2	11	2217	248	171	2636
1958	133	93	46	272	2114	171	130	2415	7	4	3	14	2254	268	179	2701
1959	138	105	49	292	2125	183	135	2443	7	4	3	14	2270	292	187	2749
1960	145	118	55	318	2139	194	138	2471	7	4	3	14	2291	316	196	2803
1961	156	129	61	346	2167	213	142	2522	7	4	3	14	2330	346	206	2882
1962	159	133	66	358	2205	227	147	2579	7	4	3	14	2371	364	216	2951
1963	167	144	69	380	2251	233	151	2635	7	4	3	14	2425	381	223	3029
1964	174	157	71	402	2292	243	157	2692	7	4	3	14	2473	404	231	3108
1965	184	168	82	434	2323	251	164	2738	7	4	3	14	2514	423	249	3186
1966	203	182	93	478	2382	258	166	2806	7	4	3	14	2592	444	262	3298
1967	296	208	113	617	2459	273	181	2913	7	4	3	14	2762	485	297	3544
1968	404	240	152	796	2522	291	187	3000	7	4	3	14	2933	535	342	3810
1969	492	252	178	922	2539	302	193	3034	7	4	4	15	3038	558	375	3971
1970	521	268	196	985	2558	308	198	3064	7	4	4	15	3086	580	398	4064
1971	564	290	211	1065	2569	316	205	3090	7	4	4	15	3140	610	420	4170
1972	583	305	229	1117	2608	325	213	3146	7	4	4	15	3198	634	446	4278
1973	602	329	239	1170	2634	335	225	3194	7	5	4	16	3243	669	468	4380
1974	623	346	243	1212	2659	346	234	3239	7	5	6	18	3289	697	483	4469
1975	635	368	253	1256	2677	365	244	3286	7	6	7	20	3319	739	504	4562
1976	651	398	259	1308	2720	397	253	3370	7	6	9	22	3378	801	521	4700
1977	675	439	273	1387	2747	430	265	3442	7	6	9	22	3429	875	547	4851
1978	695	500	296	1491	2801	472	273	3546	7	6	10	23	3503	978	579	5060
1979	730	567	318	1615	2876	520	305	3701	7	6	12	25	3613	1093	635	5341
1980	784	658	352	1794	2945	591	332	3868	7	6	13	26	3736	1255	697	5688
1981	835	719	393	1947	3007	633	363	4003	7	6	16	29	3849	1358	772	5979
1982	925	764	435	2124	3098	662	387	4147	7	6	23	36	4030	1432	845	6307
1983	1026	797	481	2304	3247	694	417	4358	7	6	26	39	4280	1497	924	6701
1984	1135	844	542	2521	3396	725	434	4555	7	6	26	39	4538	1575	1002	7115
1985	1271	909	609	2789	3557	773	471	4801	8	6	26	40	4836	1688	1106	7630
1986	1356	949	646	2951	3686	818	492	4996	8	6	28	42	5050	1773	1166	7989
1987	1449	1009	699	3157	3809	851	521	5181	8	6	28	42	5266	1866	1248	8380
1988	1521	1092	756	3369	4052	910	565	5527	8	6	28	42	5581	2008	1349	8938
1989	1586	1139	804	3529	4162	934	583	5679	8	6	28	42	5756	2079	1415	9250
1990	1587	1139	804	3530	4164	934	583	5681	8	6	28	42	5759	2079	1415	9253
Total	1587	1139	804	3530	4164	934	583	5681	8	6	28	42	5759	2079	1415	9253

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SOCUM002

Cumulative Drilling Statistics
Sour - 2000 to 2999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	1	2	2	5	269	28	20	317	0	0	0	0	270	30	22	322
1951	2	5	3	10	277	29	20	326	0	0	0	0	279	34	23	336
1952	9	8	6	23	317	31	23	371	0	0	0	0	326	39	29	394
1953	23	13	8	44	412	42	25	479	0	0	0	0	435	55	33	523
1954	38	17	9	64	471	47	31	549	0	0	0	0	509	64	40	613
1955	45	20	13	78	531	52	35	618	3	0	0	3	579	72	48	699
1956	61	32	16	109	634	56	40	730	3	0	0	3	698	88	56	842
1957	78	39	22	139	728	61	51	840	4	0	1	5	810	100	74	984
1958	86	48	28	162	896	72	58	1026	4	0	1	5	986	120	87	1193
1959	96	52	32	180	968	82	67	1117	4	0	1	5	1068	134	100	1302
1960	107	60	40	207	1073	97	82	1252	4	0	1	5	1184	157	123	1464
1961	118	82	46	246	1176	118	101	1395	4	0	1	5	1298	200	148	1646
1962	125	92	53	270	1239	140	114	1493	4	1	1	6	1368	233	168	1769
1963	134	102	55	291	1378	155	129	1662	4	1	1	6	1516	258	185	1959
1964	142	105	59	306	1476	166	143	1785	4	1	1	6	1622	272	203	2097
1965	156	114	69	339	1501	185	148	1834	4	1	1	6	1661	300	218	2179
1966	175	125	79	379	1527	209	158	1894	4	1	1	6	1706	335	238	2279
1967	183	138	83	404	1539	245	166	1950	4	1	1	6	1726	384	250	2360
1968	193	143	93	429	1544	259	170	1973	4	1	1	6	1741	403	264	2408
1969	196	146	106	448	1561	282	178	2021	4	1	1	6	1761	429	285	2475
1970	202	152	111	465	1579	303	182	2064	4	1	1	6	1785	456	294	2535
1971	204	155	120	479	1596	311	188	2095	4	1	1	6	1804	467	309	2580
1972	206	168	132	506	1620	324	193	2137	4	1	1	6	1830	493	326	2649
1973	215	183	138	536	1637	339	198	2174	4	1	1	6	1856	523	337	2716
1974	219	194	146	559	1655	349	201	2205	4	1	2	7	1878	544	349	2771
1975	223	202	150	575	1668	374	202	2244	4	1	2	7	1895	577	354	2826
1976	225	220	156	601	1681	398	209	2288	4	1	2	7	1910	619	367	2896
1977	236	247	164	647	1693	417	214	2324	4	1	2	7	1933	665	380	2978
1978	269	288	185	742	1712	443	222	2377	4	1	3	8	1985	732	410	3127
1979	303	341	209	853	1754	484	243	2481	5	1	3	9	2062	826	455	3343
1980	330	403	259	992	1793	525	251	2569	5	1	3	9	2128	929	513	3570
1981	355	450	283	1088	1809	554	266	2629	5	1	3	9	2169	1005	552	3726
1982	382	469	302	1153	1850	576	279	2705	5	1	4	10	2237	1046	585	3868
1983	404	484	323	1211	1904	585	292	2781	5	1	4	10	2313	1070	619	4002
1984	446	511	340	1297	1978	599	306	2883	5	1	4	10	2429	1111	650	4190
1985	501	541	359	1401	2050	627	336	3013	5	1	4	10	2556	1169	699	4424
1986	512	566	378	1456	2105	646	357	3108	5	1	4	10	2622	1213	739	4574
1987	541	584	395	1520	2160	660	365	3185	5	1	4	10	2706	1245	764	4715
1988	565	617	422	1604	2195	680	374	3249	5	1	4	10	2765	1298	800	4863
1989	579	635	440	1654	2205	691	377	3273	6	1	4	11	2790	1327	821	4938
1990	579	635	440	1654	2205	691	377	3273	6	1	4	11	2790	1327	821	4938
Total	579	635	440	1654	2205	691	377	3273	6	1	4	11	2790	1327	821	4938

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SOCUM003

Cumulative Drilling Statistics
Sour - 3000 to 3999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	2	2	4	1	1	0	2	0	0	0	0	1	3	2	6
1951	0	3	4	7	1	4	0	5	0	0	0	0	1	7	4	12
1952	0	4	4	8	1	4	1	6	0	0	0	0	1	8	5	14
1953	0	5	4	9	1	7	1	9	0	0	0	0	1	12	5	18
1954	2	7	5	14	2	7	1	10	0	0	0	0	4	14	6	24
1955	6	9	7	22	2	7	2	11	0	0	0	0	8	16	9	33
1956	8	11	9	28	2	8	2	12	0	0	0	0	10	19	11	40
1957	9	17	11	37	2	10	2	14	0	0	0	0	11	27	13	51
1958	10	23	13	46	13	10	6	29	0	0	0	0	23	33	19	75
1959	12	28	17	57	22	12	10	44	0	0	0	0	34	40	27	101
1960	14	33	19	66	34	21	11	66	0	0	0	0	48	54	30	132
1961	16	39	21	76	41	33	12	86	0	0	0	0	57	72	33	162
1962	18	41	23	82	42	38	14	94	0	0	0	0	60	79	37	176
1963	21	47	25	93	43	43	17	103	0	0	0	0	64	90	42	196
1964	22	54	32	108	43	44	20	107	0	0	0	0	65	98	52	215
1965	25	61	37	123	43	49	22	114	0	0	0	0	68	110	59	237
1966	26	65	38	129	44	57	22	123	0	0	0	0	70	122	60	252
1967	28	71	39	138	47	68	25	140	0	0	0	0	75	139	64	278
1968	29	85	44	158	48	108	29	185	0	0	0	0	77	193	73	343
1969	30	86	50	166	49	139	33	221	0	0	0	0	79	225	83	387
1970	30	88	53	171	49	166	38	253	0	0	0	0	79	254	91	424
1971	30	89	57	176	49	179	41	269	0	0	0	0	79	268	98	445
1972	31	94	69	194	49	183	41	273	0	0	0	0	80	277	110	467
1973	33	100	72	205	50	190	42	282	0	0	0	0	83	290	114	487
1974	34	103	79	216	50	205	45	300	0	0	0	0	84	308	124	516
1975	35	110	85	230	50	224	46	320	0	0	0	0	85	334	131	550
1976	38	128	93	259	51	235	48	334	0	0	0	0	89	363	141	593
1977	43	154	113	310	54	243	51	348	0	0	0	0	97	397	164	658
1978	51	190	120	361	55	248	53	356	0	0	0	0	106	438	173	717
1979	59	225	124	408	58	253	58	369	0	0	0	0	117	478	182	777
1980	69	279	140	488	64	265	62	391	0	0	0	0	133	544	202	879
1981	77	315	157	549	65	274	71	410	0	0	0	0	142	589	228	959
1982	79	322	168	569	68	281	72	421	0	0	0	0	147	603	240	990
1983	83	326	176	585	71	287	74	432	0	0	0	0	154	613	250	1017
1984	85	334	180	599	72	294	75	441	0	0	0	0	157	628	255	1040
1985	89	339	190	618	74	307	76	457	0	0	0	0	163	646	266	1075
1986	101	350	196	647	79	311	78	468	0	0	0	0	180	661	274	1115
1987	109	362	209	680	86	319	81	486	0	0	0	0	195	681	290	1166
1988	111	373	216	700	89	328	83	500	0	0	0	0	200	701	299	1200
1989	112	373	217	702	90	329	85	504	0	0	0	0	202	702	302	1206
1990	112	373	217	702	90	329	85	504	0	0	0	0	202	702	302	1206
Total	112	373	217	702	90	329	85	504	0	0	0	0	202	702	302	1206

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SOCUM004

Cumulative Drilling Statistics
Sour - 4000 to 4999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
1951	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
1952	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
1953	0	0	1	1	0	1	0	1	0	0	0	0	0	1	1	2
1954	0	0	1	1	0	1	0	1	0	0	0	0	0	1	1	2
1955	0	0	1	1	0	1	0	1	0	0	0	0	0	1	1	2
1956	0	1	1	2	0	1	0	1	0	0	0	0	0	2	1	3
1957	0	2	3	5	0	1	1	2	0	0	0	0	0	3	4	7
1958	0	6	4	10	0	1	1	2	0	0	0	0	0	7	5	12
1959	1	8	6	15	0	2	3	5	0	0	0	0	1	10	9	20
1960	2	10	8	20	0	5	6	11	0	0	0	0	2	15	14	31
1961	2	10	8	20	0	5	6	11	0	0	0	0	2	15	14	31
1962	2	10	10	22	0	5	6	11	0	0	0	0	2	15	16	33
1963	2	10	11	23	0	5	6	11	0	0	0	0	2	15	17	34
1964	2	11	11	24	0	5	6	11	0	0	0	0	2	16	17	35
1965	2	12	11	25	0	5	6	11	0	0	0	0	2	17	17	36
1966	2	12	12	26	0	5	6	11	0	0	0	0	2	17	18	37
1967	2	13	12	27	0	6	6	12	0	0	0	0	2	19	18	39
1968	2	17	13	32	0	6	6	12	0	0	0	0	2	23	19	44
1969	4	20	19	43	0	10	7	17	0	0	0	0	4	30	26	60
1970	4	24	30	58	0	11	11	22	0	0	0	0	4	35	41	80
1971	5	26	35	66	0	12	12	24	0	0	0	0	5	38	47	90
1972	5	28	40	73	0	13	13	26	0	0	0	0	5	41	53	99
1973	5	31	43	79	0	14	14	28	0	0	0	0	5	45	57	107
1974	6	33	45	84	0	15	15	30	0	0	0	0	6	48	60	114
1975	6	33	51	90	0	16	15	31	0	0	0	0	6	49	66	121
1976	6	44	58	108	0	18	15	33	0	0	0	0	6	62	73	141
1977	6	62	65	133	0	21	16	37	0	0	0	0	6	83	81	170
1978	6	78	73	157	0	23	17	40	0	0	0	0	6	101	90	197
1979	7	97	81	185	0	24	18	42	0	0	0	0	7	121	99	227
1980	7	116	90	213	0	24	18	42	0	0	0	0	7	140	108	255
1981	7	129	94	230	0	25	20	45	0	0	0	0	7	154	114	275
1982	8	131	96	235	0	25	21	46	0	0	0	0	8	156	117	281
1983	9	131	97	237	0	27	21	48	0	0	0	0	9	158	118	285
1984	9	132	101	242	0	27	21	48	0	0	0	0	9	159	122	290
1985	9	133	104	246	0	30	21	51	0	0	0	0	9	163	125	297
1986	9	135	106	250	0	31	23	54	0	0	0	0	9	166	129	304
1987	9	136	109	254	0	33	25	58	0	0	0	0	9	169	134	312
1988	9	140	113	262	0	36	27	63	0	0	0	0	9	176	140	325
1989	9	140	113	262	0	36	28	64	0	0	0	0	9	176	141	326
1990	9	140	113	262	0	36	28	64	0	0	0	0	9	176	141	326
Total	9	140	113	262	0	36	28	64	0	0	0	0	9	176	141	326

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SOCUM005

Cumulative Drilling Statistics
Sour - Total of All Depths

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	33	35	25	93	1603	211	82	1896	0	1	73	74	1636	247	180	2063
1951	59	57	33	149	2112	232	97	2441	2	1	85	88	2173	290	215	2678
1952	90	81	40	211	2561	262	129	2952	5	1	95	101	2656	344	264	3264
1953	119	96	50	265	2909	289	158	3356	6	1	100	107	3034	386	308	3728
1954	144	109	57	310	3072	302	170	3544	6	1	106	113	3222	412	333	3967
1955	167	123	68	358	3207	317	187	3711	9	1	111	121	3383	441	366	4190
1956	200	148	78	426	3363	334	198	3895	9	1	117	127	3572	483	393	4448
1957	225	175	95	495	3496	350	214	4060	11	3	122	136	3732	528	431	4691
1958	240	206	112	558	3709	373	229	4311	11	5	126	142	3960	584	467	5011
1959	258	232	127	617	3803	402	249	4454	11	5	133	149	4072	639	509	5220
1960	279	263	145	687	3936	443	273	4652	11	5	142	158	4226	711	560	5497
1961	303	304	159	766	4076	499	298	4873	11	5	158	174	4390	808	615	5813
1962	315	322	176	813	4178	544	319	5041	11	6	163	180	4504	872	658	6034
1963	335	349	186	870	4368	571	341	5280	11	6	167	184	4714	926	694	6334
1964	354	375	201	930	4517	598	365	5480	11	6	172	189	4882	979	738	6599
1965	384	411	234	1029	4578	631	382	5591	11	7	175	193	4973	1049	791	6813
1966	426	444	258	1128	4672	670	397	5739	11	7	186	204	5109	1121	841	7071
1967	530	494	286	1310	4772	734	426	5932	11	8	208	227	5313	1236	920	7469
1968	652	556	345	1553	4859	814	444	6117	11	8	240	259	5522	1378	1029	7929
1969	751	584	397	1732	4900	891	467	6258	11	8	246	265	5662	1483	1110	8255
1970	786	621	437	1844	4940	958	490	6388	11	8	249	268	5737	1587	1176	8500
1971	834	659	476	1969	4973	1006	510	6489	11	8	254	273	5818	1673	1240	8731
1972	861	716	526	2103	5050	1046	527	6623	11	10	261	282	5922	1772	1314	9008
1973	896	793	558	2247	5104	1098	550	6752	11	11	276	298	6011	1902	1384	9297
1974	931	852	589	2372	5161	1166	575	6902	11	11	282	304	6103	2029	1446	9578
1975	955	938	624	2517	5196	1274	589	7059	11	12	292	315	6162	2224	1505	9891
1976	980	1121	665	2766	5264	1410	615	7289	11	13	299	323	6255	2544	1579	10378
1977	1029	1318	727	3074	5323	1523	649	7495	11	13	307	331	6363	2854	1683	10900
1978	1096	1537	799	3432	5419	1646	680	7745	11	13	312	336	6526	3196	1791	11513
1979	1187	1762	866	3815	5573	1812	750	8135	12	13	318	343	6772	3587	1934	12293
1980	1289	2047	991	4327	5714	1991	805	8510	12	14	323	349	7015	4052	2119	13186
1981	1391	2262	1099	4752	5820	2123	885	8828	12	14	327	353	7223	4399	2311	13933
1982	1517	2360	1189	5066	5978	2203	944	9125	12	15	338	365	7507	4578	2471	14556
1983	1661	2429	1278	5368	6228	2264	998	9490	12	15	341	368	7901	4708	2617	15226
1984	1833	2535	1380	5748	6520	2340	1051	9911	13	15	353	381	8366	4890	2784	16040
1985	2042	2650	1491	6183	6814	2466	1136	10416	14	15	357	386	8870	5131	2984	16985
1986	2155	2750	1581	6486	7066	2567	1198	10831	14	15	359	388	9235	5332	3138	17705
1987	2300	2869	1675	6844	7372	2660	1258	11290	14	15	361	390	9686	5544	3294	18524
1988	2424	3051	1800	7275	7886	2804	1382	12072	14	15	361	390	10324	5870	3543	19737
1989	2536	3153	1898	7587	8138	2877	1434	12449	15	15	362	392	10689	6045	3694	20428
1990	2539	3153	1898	7590	8140	2877	1434	12451	15	15	362	392	10694	6045	3694	20433
Total	2539	3153	1898	7590	8140	2877	1434	12451	15	15	362	392	10694	6045	3694	20433

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCUM006

Table 3.27

Historical Drilling Statistics
Sweet & Sour - 0 to 999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	24	63	1159	1246	853	239	831	1923	1	37	277	315	878	339	2267	3484
1951	11	19	65	95	162	29	35	226	0	3	19	22	173	51	119	343
1952	25	33	104	162	192	48	77	317	0	0	16	16	217	81	197	495
1953	22	20	114	156	101	44	71	216	0	0	15	15	123	64	200	387
1954	16	18	93	127	56	49	54	159	0	2	16	18	72	69	163	304
1955	2	21	57	80	80	35	43	158	1	0	11	12	83	56	111	250
1956	7	19	60	86	86	22	36	144	0	1	36	37	93	42	132	267
1957	9	22	104	135	79	15	32	126	0	2	69	71	88	39	205	332
1958	7	23	97	127	84	55	39	178	0	4	191	195	91	82	327	500
1959	3	28	89	120	43	84	24	151	0	6	70	76	46	118	183	347
1960	7	29	83	119	28	47	20	95	0	3	55	58	35	79	158	272
1961	1	25	59	85	21	58	29	108	0	1	59	60	22	84	147	253
1962	6	19	63	88	44	57	43	144	0	2	53	55	50	78	159	287
1963	9	17	82	108	40	87	51	178	0	1	39	40	49	105	172	326
1964	13	32	109	154	71	46	41	158	0	3	48	51	84	81	198	363
1965	30	40	237	307	82	53	82	217	0	4	37	41	112	97	356	565
1966	22	40	212	274	109	67	92	268	0	2	43	45	131	109	347	587
1967	14	27	165	206	126	68	122	316	0	2	52	54	140	97	339	576
1968	16	44	183	243	128	117	178	423	0	4	71	75	144	165	432	741
1969	17	50	246	313	92	168	146	406	0	4	54	58	109	222	446	777
1970	3	102	312	417	89	271	109	469	0	1	36	37	92	374	457	923
1971	27	126	273	426	108	361	137	606	0	2	33	35	135	489	443	1067
1972	14	165	333	512	132	605	185	922	0	2	31	33	146	772	549	1467
1973	31	367	463	861	174	781	253	1208	1	1	33	35	206	1149	749	2104
1974	25	244	420	689	293	1003	266	1562	1	0	12	13	319	1247	698	2264
1975	25	331	431	787	384	1146	284	1814	0	3	28	31	409	1480	743	2632
1976	33	778	488	1299	217	1640	392	2249	1	2	31	34	251	2420	911	3582
1977	65	672	509	1246	241	1612	299	2152	2	1	19	22	308	2285	827	3420
1978	46	519	458	1023	265	1734	351	2350	1	0	10	11	312	2253	819	3384
1979	42	338	342	722	292	1786	358	2436	0	4	10	14	334	2128	710	3172
1980	51	487	386	924	375	2002	466	2843	0	1	13	14	426	2490	865	3781
1981	51	359	491	901	330	1465	434	2229	0	0	12	12	381	1824	937	3142
1982	34	181	376	591	325	1360	398	2083	0	3	14	17	359	1544	788	2691
1983	29	79	188	296	433	468	434	1335	0	0	3	3	462	547	625	1634
1984	64	119	274	457	571	614	732	1917	5	1	33	39	640	734	1039	2413
1985	79	97	306	482	715	1188	1201	3104	3	0	64	67	797	1285	1571	3653
1986	30	94	228	352	301	363	410	1074	1	0	23	24	332	457	661	1450
1987	51	93	224	368	474	242	653	1369	1	0	15	16	526	335	892	1753
1988	74	174	343	591	604	482	995	2081	1	4	59	64	679	660	1397	2736
1989	54	93	487	634	311	249	365	925	0	0	23	23	365	342	875	1582
1990	4	3	61	68	4	6	67	77	0	0	0	0	8	9	128	145
Total	1093	6010	10774	17877	9115	20766	10835	40716	19	106	1733	1858	10227	26882	23342	60451

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCDSS01

Historical Drilling Statistics
Sweet & Sour - 1000 to 1999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	45	47	449	541	839	129	218	1186	0	1	1	2	884	177	668	1729
1951	39	38	210	287	511	12	84	607	2	0	0	2	552	50	294	896
1952	44	36	245	325	592	15	140	747	3	0	0	3	639	51	385	1075
1953	31	30	163	224	474	14	121	609	3	0	0	3	508	44	284	836
1954	28	21	125	174	452	12	71	535	0	0	0	0	480	33	196	709
1955	51	30	119	200	827	26	111	964	0	1	0	1	878	57	230	1165
1956	41	32	172	245	993	32	119	1144	0	2	0	2	1034	66	291	1391
1957	50	27	178	255	534	21	53	608	3	4	2	9	587	52	233	872
1958	26	23	164	213	577	27	127	731	0	3	2	5	603	53	293	949
1959	35	49	179	263	481	31	98	610	0	0	0	0	516	80	277	873
1960	24	41	151	216	381	35	110	526	0	0	1	1	405	76	262	743
1961	29	28	163	220	258	52	115	425	0	0	0	0	287	80	278	645
1962	18	31	186	235	316	54	177	547	0	0	1	1	334	85	364	783
1963	31	35	164	230	322	25	135	482	0	0	0	0	353	60	299	712
1964	52	56	276	384	319	37	153	509	0	0	0	0	371	93	429	893
1965	73	41	291	405	398	25	167	590	0	0	0	0	471	66	458	995
1966	40	37	276	353	276	12	103	391	0	0	0	0	316	49	379	744
1967	117	54	300	471	240	30	116	386	0	0	0	0	357	84	416	857
1968	144	69	416	629	182	36	105	323	1	0	1	2	327	105	522	954
1969	112	51	400	563	120	25	112	257	0	0	1	1	232	76	513	821
1970	49	69	332	450	102	31	86	219	0	0	1	1	151	100	419	670
1971	63	75	300	438	99	58	148	305	0	0	9	9	162	133	457	752
1972	38	92	380	510	222	73	135	430	0	0	0	0	260	165	515	940
1973	61	148	397	606	205	69	199	473	0	3	8	11	266	220	604	1090
1974	49	105	349	503	166	83	158	407	1	0	6	7	216	188	513	917
1975	32	118	288	438	145	103	109	357	0	2	7	9	177	223	404	804
1976	64	211	338	613	177	154	151	482	0	2	7	9	241	367	496	1104
1977	95	287	394	776	215	144	180	539	0	0	12	12	310	431	586	1327
1978	101	319	490	910	288	196	183	667	0	1	6	7	389	516	679	1584
1979	109	271	453	833	390	221	287	898	0	0	5	5	499	492	745	1736
1980	150	390	530	1070	467	343	341	1151	0	0	2	2	617	733	873	2223
1981	161	263	538	962	360	195	307	862	0	0	4	4	521	458	849	1828
1982	224	161	445	830	449	159	300	908	0	0	8	8	673	320	753	1746
1983	215	103	454	772	691	152	327	1170	0	0	3	3	906	255	784	1945
1984	304	158	611	1073	833	136	453	1422	7	1	4	12	1144	295	1068	2507
1985	377	165	762	1304	842	171	519	1532	5	1	12	18	1224	337	1293	2854
1986	244	124	564	932	647	145	369	1161	3	3	11	17	894	272	944	2110
1987	296	185	656	1137	766	187	375	1328	2	1	4	7	1064	373	1035	2472
1988	244	212	779	1235	817	193	505	1515	4	4	11	19	1065	409	1295	2769
1989	159	99	763	1021	356	85	317	758	0	2	5	7	515	186	1085	1786
1990	6	3	98	107	6	1	60	67	0	0	2	2	12	4	160	176
Total	4071	4334	14548	22953	17335	3549	7944	28828	34	31	136	201	21440	7914	22628	51982

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCDSS02

Historical Drilling Statistics
Sweet & Sour - 2000 to 2999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	2	2	83	87	271	29	38	338	0	0	0	0	273	31	121	425
1951	3	5	22	30	8	1	1	10	0	0	0	0	11	6	23	40
1952	9	8	42	59	40	3	7	50	0	0	0	0	49	11	49	109
1953	19	9	50	78	96	11	11	118	0	0	0	0	115	20	61	196
1954	28	6	54	88	62	5	17	84	0	0	0	0	90	11	71	172
1955	16	7	60	83	75	6	15	96	3	0	0	3	94	13	75	182
1956	31	16	57	104	125	4	12	141	0	0	0	0	156	20	69	245
1957	23	14	74	111	116	7	32	155	1	0	2	3	140	21	108	269
1958	20	16	77	113	202	11	25	238	0	1	0	1	222	28	102	352
1959	33	10	69	112	202	13	46	261	0	0	0	0	235	23	115	373
1960	35	15	107	157	363	24	79	466	0	0	0	0	398	39	186	623
1961	38	26	91	155	376	32	104	512	0	0	0	0	414	58	195	667
1962	19	19	94	132	248	32	97	377	0	1	0	1	267	52	191	510
1963	25	15	93	133	375	22	96	493	0	0	0	0	400	37	189	626
1964	40	11	97	148	346	22	79	447	0	0	0	0	386	33	176	595
1965	39	13	127	179	212	20	58	290	0	0	0	0	251	33	185	469
1966	30	17	120	167	109	28	35	172	0	0	0	0	139	45	155	339
1967	14	21	78	113	62	40	26	128	0	0	0	0	76	61	104	241
1968	14	7	92	113	42	20	25	87	0	0	0	0	56	27	117	200
1969	6	7	97	110	58	38	44	140	0	0	0	0	64	45	141	250
1970	9	12	77	98	44	26	37	107	0	0	0	0	53	38	114	205
1971	10	6	94	110	36	15	32	83	0	0	0	0	46	21	126	193
1972	9	17	104	130	62	21	36	1:9	0	0	0	0	71	38	140	249
1973	23	27	104	154	81	25	48	154	0	0	0	0	104	52	152	308
1974	25	27	108	160	85	17	49	151	0	0	2	2	110	44	159	313
1975	26	24	74	124	79	40	38	157	0	0	0	0	105	64	112	281
1976	33	49	81	163	72	38	35	145	0	0	0	0	105	87	116	308
1977	28	66	123	217	59	35	26	120	0	0	0	0	87	101	149	337
1978	56	124	150	330	101	46	61	208	0	2	1	3	157	172	212	541
1979	82	152	164	398	183	78	72	333	1	0	1	2	266	230	237	733
1980	81	162	218	461	205	97	70	372	0	0	0	0	286	259	288	833
1981	70	105	165	340	103	68	76	247	0	0	0	0	173	173	241	587
1982	104	64	132	300	164	51	62	277	0	0	1	1	268	115	195	578
1983	102	38	135	275	226	25	49	300	1	0	0	1	329	63	184	576
1984	116	59	187	362	273	38	60	371	5	0	1	6	394	97	248	739
1985	133	61	234	428	288	51	110	449	3	0	4	7	424	112	348	884
1986	47	50	139	236	209	51	87	347	2	0	4	6	258	101	230	589
1987	93	43	185	321	213	48	84	345	0	2	2	4	306	93	271	670
1988	79	79	227	385	144	68	94	306	1	0	5	6	224	147	326	697
1989	33	37	230	300	60	17	80	157	2	0	4	6	95	54	314	463
1990	0	0	16	16	1	0	9	10	0	0	0	0	1	0	25	26
Total	1603	1446	4531	7580	6076	1223	2062	9361	19	6	27	52	7698	2675	6620	16993

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCDSS03

Historical Drilling Statistics
Sweet & Sour - 3000 to 3999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	4	13	17	1	2	10	13	0	0	0	0	1	6	23	30
1951	0	1	4	5	0	3	0	3	0	0	0	0	0	4	4	8
1952	0	2	4	6	0	0	1	1	0	0	0	0	0	2	5	7
1953	1	2	3	6	0	3	0	3	0	0	0	0	1	5	3	9
1954	2	4	12	18	1	0	0	1	0	0	0	0	3	4	12	19
1955	4	4	29	37	1	0	3	4	0	0	0	0	5	4	32	41
1956	2	3	18	23	0	1	1	2	0	0	0	0	2	4	19	25
1957	2	6	23	31	1	2	0	3	0	0	0	0	3	8	23	34
1958	3	10	22	35	17	0	10	27	0	0	0	0	20	10	32	62
1959	3	9	28	40	20	2	14	36	0	0	0	0	23	11	42	76
1960	3	7	20	30	20	10	5	35	0	0	0	0	23	17	25	65
1961	4	7	24	35	7	13	5	25	0	0	0	0	11	20	29	60
1962	3	5	21	29	2	5	7	14	0	0	0	0	5	10	28	43
1963	7	6	25	38	6	5	8	19	0	0	0	0	13	11	33	57
1964	3	10	28	41	4	1	4	9	0	0	0	0	7	11	32	50
1965	3	8	27	38	5	5	5	15	0	0	0	0	8	13	32	53
1966	3	5	22	30	4	9	7	20	0	0	0	0	7	14	29	50
1967	2	9	17	28	5	11	8	24	0	0	0	0	7	20	25	52
1968	2	16	32	50	3	43	11	57	0	0	0	0	5	59	43	107
1969	2	2	34	38	1	32	8	41	0	0	0	0	3	34	42	79
1970	0	2	27	29	0	27	8	35	0	0	0	0	0	29	35	64
1971	0	3	25	28	0	13	10	23	0	0	0	0	0	16	35	51
1972	3	6	37	46	0	4	1	5	0	0	0	0	3	10	38	51
1973	3	9	36	48	1	10	2	13	0	0	0	0	4	19	38	61
1974	2	8	32	42	0	15	6	21	0	0	0	0	2	23	38	63
1975	3	10	26	39	0	20	3	23	0	0	0	0	3	30	29	62
1976	7	28	44	79	1	12	7	20	0	0	0	0	8	40	51	99
1977	7	39	58	104	3	11	5	19	0	0	0	0	10	50	63	123
1978	21	51	41	113	3	5	6	14	0	0	0	0	24	56	47	127
1979	21	69	35	125	7	6	7	20	0	0	0	0	28	75	42	145
1980	15	95	54	164	7	14	7	28	0	0	0	0	22	109	61	192
1981	13	57	60	130	1	11	10	22	0	0	0	0	14	68	70	152
1982	3	13	47	63	4	11	2	17	0	0	0	0	7	24	49	80
1983	9	11	31	51	6	15	9	30	0	0	0	0	15	26	40	81
1984	5	12	30	47	3	16	6	25	0	1	0	1	8	29	36	73
1985	10	9	31	50	8	16	11	35	0	0	1	1	18	25	43	86
1986	14	13	16	43	7	7	10	24	1	0	0	1	22	20	26	68
1987	9	18	40	67	8	15	6	29	0	1	0	1	17	34	46	97
1988	5	15	35	55	9	17	8	34	1	1	0	2	15	33	43	91
1989	2	3	35	40	2	2	6	10	0	0	0	0	4	5	41	50
1990	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
Total	201	591	1147	1939	168	394	237	799	2	3	1	6	371	988	1385	2744

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCDSS04

Historical Drilling Statistics
Sweet & Sour - 4000 to 4999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	0	0	0	0	1	1	2	0	0	0	0	0	1	1	2
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	2
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
1956	0	1	5	6	0	0	0	0	0	0	0	0	0	1	5	6
1957	0	1	4	5	0	0	1	1	0	0	0	0	0	1	5	6
1958	0	4	3	7	0	0	1	1	0	0	0	0	0	4	4	8
1959	1	2	5	8	0	1	3	4	0	0	0	0	1	3	8	12
1960	1	2	7	10	0	3	4	7	0	0	0	0	1	5	11	17
1961	1	0	6	7	0	0	0	0	0	0	0	0	1	0	6	7
1962	0	0	4	4	0	0	3	3	0	0	0	0	0	0	7	7
1963	0	0	5	5	0	0	0	0	0	0	0	0	0	0	5	5
1964	0	2	7	9	0	0	0	0	0	0	0	0	0	2	7	9
1965	0	1	7	8	0	0	0	0	0	0	0	0	0	1	7	8
1966	0	0	4	4	0	0	0	0	0	0	0	0	0	0	4	4
1967	0	1	1	2	0	1	1	2	0	0	0	0	0	2	2	4
1968	0	4	1	5	0	0	0	0	0	0	0	0	0	4	1	5
1969	2	3	15	20	0	4	1	5	0	0	0	0	2	7	16	25
1970	0	6	28	34	1	1	4	6	0	0	0	0	1	7	32	40
1971	1	2	14	17	0	1	1	2	0	0	0	0	1	3	15	19
1972	0	4	13	17	0	1	1	2	0	0	0	0	0	5	14	19
1973	0	3	10	13	0	1	4	5	0	0	0	0	0	4	14	18
1974	1	4	10	15	0	1	1	2	0	0	0	0	1	5	11	17
1975	0	0	13	13	0	1	1	2	0	0	0	0	0	1	14	15
1976	0	14	10	24	0	2	0	2	0	0	0	0	0	16	10	26
1977	0	25	15	40	0	3	1	4	0	0	0	0	0	28	16	44
1978	0	22	20	42	0	3	1	4	0	0	0	0	0	25	21	46
1979	1	23	26	50	0	2	1	3	0	0	0	0	1	25	27	53
1980	1	28	27	56	0	0	2	2	0	0	0	0	1	28	29	58
1981	0	19	23	42	0	1	2	3	0	0	0	0	0	20	25	45
1982	1	6	13	20	0	0	1	1	0	0	0	0	1	6	14	21
1983	1	0	5	6	0	2	0	2	0	0	0	0	1	2	5	8
1984	0	2	12	14	0	0	0	0	0	0	0	0	0	2	12	14
1985	0	2	7	9	0	3	0	3	0	1	0	1	0	6	7	13
1986	0	4	6	10	0	1	2	3	0	0	0	0	0	5	8	13
1987	0	1	7	8	0	2	3	5	0	0	0	0	0	3	10	13
1988	0	5	14	19	0	3	2	5	0	0	0	0	0	8	16	24
1989	0	0	13	13	0	0	1	1	0	0	1	1	0	0	15	15
1990	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	2
Total	11	191	365	567	1	38	43	82	0	1	1	2	12	230	409	651

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SWCDSS05

Historical Drilling Statistics
Sweet & Sour - Total of All Depths

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	71	116	1704	1891	1964	400	1098	3462	1	38	278	317	2036	554	3080	5670
1951	53	63	301	417	681	45	120	846	2	3	19	24	736	111	440	1287
1952	78	79	395	552	824	66	225	1115	3	0	16	19	905	145	636	1686
1953	73	61	332	466	671	72	203	946	3	0	15	18	747	133	550	1430
1954	74	49	284	407	571	66	142	779	0	2	16	18	645	117	442	1204
1955	73	62	266	401	983	67	172	1222	4	1	11	16	1060	130	449	1639
1956	81	71	312	464	1204	59	168	1431	0	3	36	39	1285	133	516	1934
1957	84	70	383	537	730	45	118	893	4	6	73	83	818	121	574	1513
1958	56	76	363	495	880	93	202	1175	0	8	193	201	936	177	758	1871
1959	75	98	370	543	746	131	185	1062	0	6	70	76	821	235	625	1681
1960	70	94	368	532	792	119	218	1129	0	3	56	59	862	216	642	1720
1961	73	86	343	502	662	155	253	1070	0	1	59	60	735	242	655	1632
1962	46	74	368	488	610	148	327	1085	0	3	54	57	656	225	749	1630
1963	72	73	369	514	743	139	290	1172	0	1	39	40	815	213	698	1726
1964	108	111	517	736	740	106	277	1123	0	3	48	51	848	220	842	1910
1965	145	103	689	937	697	103	312	1112	0	4	37	41	842	210	1038	2090
1966	95	99	634	828	498	116	237	851	0	2	43	45	593	217	914	1724
1967	147	112	561	820	433	150	273	856	0	2	52	54	580	264	886	1730
1968	176	140	724	1040	355	216	319	890	1	4	72	77	532	360	1115	2007
1969	139	113	792	1044	271	267	311	849	0	4	55	59	410	384	1158	1952
1970	61	191	776	1028	236	356	244	836	0	1	37	38	297	548	1057	1902
1971	101	212	706	1019	243	448	328	1019	0	2	42	44	344	662	1076	2082
1972	64	284	867	1215	416	704	358	1478	0	2	31	33	480	990	1256	2726
1973	118	554	1010	1682	461	886	506	1853	1	4	41	46	580	1444	1557	3581
1974	102	388	919	1409	544	1119	480	2143	2	0	20	22	648	1507	1419	3574
1975	86	483	832	1401	608	1310	435	2353	0	5	35	40	694	1798	1302	3794
1976	137	1080	961	2178	467	1846	585	2898	1	4	38	43	605	2930	1584	5119
1977	195	1089	1099	2383	518	1805	511	2834	2	1	31	34	715	2895	1641	5251
1978	224	1035	1159	2418	657	1984	602	3243	1	3	17	21	882	3022	1778	5682
1979	255	853	1020	2128	872	2093	725	3690	1	4	16	21	1128	2950	1761	5839
1980	298	1162	1215	2675	1054	2456	886	4396	0	1	15	16	1352	3619	2116	7087
1981	295	803	1277	2375	794	1740	829	3363	0	0	16	16	1089	2543	2122	5754
1982	366	425	1013	1804	942	1581	763	3286	0	3	23	26	1308	2009	1799	5116
1983	356	231	813	1400	1356	662	819	2837	1	0	6	7	1713	893	1638	4244
1984	489	350	1114	1953	1680	804	1251	3735	17	3	38	58	2186	1157	2403	5746
1985	599	334	1340	2273	1853	1429	1841	5123	11	2	81	94	2463	1765	3262	7490
1986	335	285	953	1573	1164	567	878	2609	7	3	38	48	1506	855	1869	4230
1987	449	340	1112	1901	1461	494	1121	3076	3	4	21	28	1913	838	2254	5005
1988	402	485	1398	2285	1574	763	1604	3941	7	9	75	91	1983	1257	3077	6317
1989	248	232	1528	2008	729	353	769	1851	2	2	33	37	979	587	2330	3896
1990	10	6	178	194	11	7	136	154	0	0	2	2	21	13	316	350
Total	6979	12572	31365	50916	32695	25970	21121	79786	74	147	1898	2119	39748	38689	54384	132821

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)

Table 3.28

Cumulative Drilling Statistics
Sweet & Sour - 0 to 999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	24	63	1159	1246	853	239	831	1923	1	37	277	315	878	339	2267	3484
1951	35	82	1224	1341	1015	268	866	2149	1	40	296	337	1051	390	2386	3827
1952	60	115	1328	1503	1207	316	943	2466	1	40	312	353	1268	471	2583	4322
1953	82	135	1442	1659	1308	360	1014	2682	1	40	327	368	1391	535	2783	4709
1954	98	153	1535	1786	1364	409	1068	2841	1	42	343	386	1463	604	2946	5013
1955	100	174	1592	1866	1444	444	1111	2999	2	42	354	398	1546	660	3057	5263
1956	107	193	1652	1952	1530	466	1147	3143	2	43	390	435	1639	702	3189	5530
1957	116	215	1756	2087	1609	481	1179	3269	2	45	459	506	1727	741	3394	5862
1958	123	238	1853	2214	1693	536	1218	3447	2	49	650	701	1818	823	3721	6362
1959	126	266	1942	2334	1736	620	1242	3598	2	55	720	777	1864	941	3904	6709
1960	133	295	2025	2453	1764	667	1262	3693	2	58	775	835	1899	1020	4062	6981
1961	134	320	2084	2538	1785	725	1291	3801	2	59	834	895	1921	1104	4209	7234
1962	140	339	2147	2626	1829	782	1334	3945	2	61	887	950	1971	1182	4368	7521
1963	149	356	2229	2734	1869	869	1385	4123	2	62	926	990	2020	1287	4540	7847
1964	162	388	2338	2888	1940	915	1426	4281	2	65	974	1041	2104	1368	4738	8210
1965	192	428	2575	3195	2022	968	1508	4498	2	69	1011	1082	2216	1465	5094	8775
1966	214	468	2787	3469	2131	1035	1600	4766	2	71	1054	1127	2347	1574	5441	9362
1967	228	495	2952	3675	2257	1103	1722	5082	2	73	1106	1181	2487	1671	5780	9938
1968	244	539	3135	3918	2385	1220	1900	5505	2	77	1177	1256	2631	1836	6212	10679
1969	261	589	3381	4231	2477	1388	2046	5911	2	81	1231	1314	2740	2058	6658	11456
1970	264	691	3693	4648	2566	1659	2155	6380	2	82	1267	1351	2832	2432	7115	12379
1971	291	817	3966	5074	2674	2020	2292	6986	2	84	1300	1386	2967	2921	7558	13446
1972	305	982	4299	5586	2806	2625	2477	7908	2	86	1331	1419	3113	3693	8107	14913
1973	336	1349	4762	6447	2980	3406	2730	9116	3	87	1364	1454	3319	4842	8856	17017
1974	361	1593	5182	7136	3273	4409	2996	10678	4	87	1376	1467	3638	6089	9554	19281
1975	386	1924	5613	7923	3657	5555	3280	12492	4	90	1404	1498	4047	7569	10297	21913
1976	419	2702	6101	9222	3874	7195	3672	14741	5	92	1435	1532	4298	9989	11208	25495
1977	484	3374	6610	10468	4115	8807	3971	16893	7	93	1454	1554	4606	12274	12035	28915
1978	530	3893	7068	11491	4380	10541	4322	19243	8	93	1464	1565	4918	14527	12854	32299
1979	572	4231	7410	12213	4672	12327	4680	21679	8	97	1474	1579	5252	16655	13564	35471
1980	623	4718	7796	13137	5047	14329	5146	24522	8	98	1487	1593	5678	19145	14429	39252
1981	674	5077	8287	14038	5377	15794	5580	26751	8	98	1499	1605	6059	20969	15366	42394
1982	708	5258	8663	14629	5702	17154	5978	28834	8	101	1513	1622	6418	22513	16154	45085
1983	737	5337	8851	14925	6135	17622	6412	30169	8	101	1516	1625	6880	23060	16779	46719
1984	801	5456	9125	15382	6706	18236	7144	32086	13	102	1549	1664	7520	23794	17818	49132
1985	880	5553	9431	15864	7421	19424	8345	35190	16	102	1613	1731	8317	25079	19389	52785
1986	910	5647	9659	16216	7722	19787	8755	36264	17	102	1636	1755	8649	25536	20050	54235
1987	961	5740	9883	16584	8196	20029	9408	37633	18	102	1651	1771	9175	25871	20942	55988
1988	1035	5914	10226	17175	8800	20511	10403	39714	19	106	1710	1835	9854	26531	22339	58724
1989	1089	6007	10713	17809	9111	20760	10768	40639	19	106	1733	1858	10219	26873	23214	60306
1990	1093	6010	10774	17877	9115	20766	10835	40716	19	106	1733	1858	10227	26882	23342	60451
Total	1093	6010	10774	17877	9115	20766	10835	40716	19	106	1733	1858	10227	26882	23342	60451

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SSCUM0001

Cumulative Drilling Statistics
Sweet & Sour -1000 to 1999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	45	47	449	541	839	129	218	1186	0	1	1	2	884	177	668	1729
1951	84	85	659	828	1350	141	302	1793	2	1	1	4	1436	227	962	2625
1952	128	121	904	1153	1942	156	442	2540	5	1	1	7	2075	278	1347	3700
1953	159	151	1067	1377	2416	170	563	3149	8	1	1	10	2583	322	1631	4536
1954	187	172	1192	1551	2868	182	634	3684	8	1	1	10	3063	355	1827	5245
1955	238	202	1311	1751	3695	208	745	4648	8	2	1	11	3941	412	2057	6410
1956	279	234	1483	1996	4688	240	864	5792	8	4	1	13	4975	478	2348	7801
1957	329	261	1661	2251	5222	261	917	6400	11	8	3	22	5562	530	2581	8673
1958	355	284	1825	2464	5799	288	1044	7131	11	11	5	27	6165	583	2874	9622
1959	390	333	2004	2727	6280	319	1142	7741	11	11	5	27	6681	663	3151	10495
1960	414	374	2155	2943	6661	354	1252	8267	11	11	6	28	7086	739	3413	11238
1961	443	402	2318	3163	6919	406	1367	8692	11	11	6	28	7373	819	3691	11883
1962	461	433	2504	3398	7235	460	1544	9239	11	11	7	29	7707	904	4055	12666
1963	492	468	2668	3628	7557	485	1679	9721	11	11	7	29	8060	964	4354	13378
1964	544	524	2944	4012	7876	522	1832	10230	11	11	7	29	8431	1057	4783	14271
1965	617	565	3235	4417	8274	547	1999	10820	11	11	7	29	8902	1123	5241	15266
1966	657	602	3511	4770	8550	559	2102	11211	11	11	7	29	9218	1172	5620	16010
1967	774	656	3811	5241	8790	589	2218	11597	11	11	7	29	9575	1256	6036	16867
1968	918	725	4227	5870	8972	625	2323	11920	12	11	8	31	9902	1361	6558	17821
1969	1030	776	4627	6433	9092	650	2435	12177	12	11	9	32	10134	1437	7071	18642
1970	1079	845	4959	6883	9194	681	2521	12396	12	11	10	33	10285	1537	7490	19312
1971	1142	920	5259	7321	9293	739	2669	12701	12	11	19	42	10447	1670	7947	20064
1972	1180	1012	5639	7831	9515	812	2804	13131	12	11	19	42	10707	1835	8462	21004
1973	1241	1160	6036	8437	9720	881	3003	13604	12	14	27	53	10973	2055	9066	22094
1974	1290	1265	6385	8940	9886	964	3161	14011	13	14	33	60	11189	2243	9579	23011
1975	1322	1383	6673	9378	10031	1067	3270	14368	13	16	40	69	11366	2466	9983	23815
1976	1386	1594	7011	9991	10208	1221	3421	14850	13	18	47	78	11607	2833	10479	24919
1977	1481	1881	7405	10767	10423	1365	3601	15389	13	18	59	90	11917	3264	11065	26246
1978	1582	2200	7895	11677	10711	1561	3784	16056	13	19	65	97	12306	3780	11744	27830
1979	1691	2471	8348	12510	11101	1782	4071	16954	13	19	70	102	12805	4272	12489	29566
1980	1841	2861	8878	13580	11568	2125	4412	18105	13	19	72	104	13422	5005	13362	31789
1981	2002	3124	9416	14542	11928	2320	4719	18967	13	19	76	108	13943	5463	14211	33617
1982	2226	3285	9861	15372	12377	2479	5019	19875	13	19	84	116	14616	5783	14964	35363
1983	2441	3388	10315	16144	13068	2631	5346	21045	13	19	87	119	15522	6038	15748	37308
1984	2745	3546	10926	17217	13901	2767	5799	22467	20	20	91	131	16666	6333	16816	39815
1985	3122	3711	11688	18521	14743	2938	6318	23999	25	21	103	149	17890	6670	18109	42669
1986	3366	3835	12252	19453	15390	3083	6687	25160	28	24	114	166	18784	6942	19053	44779
1987	3662	4020	12908	20590	16156	3270	7062	26488	30	25	118	173	19848	7315	20088	47251
1988	3906	4232	13687	21825	16973	3463	7567	28003	34	29	129	192	20913	7724	21383	50020
1989	4065	4331	14450	22846	17329	3548	7884	28761	34	31	134	199	21428	7910	22468	51806
1990	4071	4334	14548	22953	17335	3549	7944	28828	34	31	136	201	21440	7914	22628	51982
Total	4071	4334	14548	22953	17335	3549	7944	28828	34	31	136	201	21440	7914	22628	51982

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SSCUM0002

Cumulative Drilling Statistics
Sweet & Sour - 2000 to 2999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	2	2	83	87	271	29	38	338	0	0	0	0	273	31	121	425
1951	5	7	105	117	279	30	39	348	0	0	0	0	284	37	144	465
1952	14	15	147	176	319	33	46	398	0	0	0	0	333	48	193	574
1953	33	24	197	254	415	44	57	516	0	0	0	0	448	68	254	770
1954	61	30	251	342	477	49	74	600	0	0	0	0	538	79	325	942
1955	77	37	311	425	552	55	89	696	3	0	0	3	632	92	400	1124
1956	108	53	368	529	677	59	101	837	3	0	0	3	788	112	469	1369
1957	131	67	442	640	793	66	133	992	4	0	2	6	928	133	577	1638
1958	151	83	519	753	995	77	158	1230	4	1	2	7	1150	161	679	1990
1959	184	93	588	865	1197	90	204	1491	4	1	2	7	1385	184	794	2363
1960	219	108	695	1022	1560	114	283	1957	4	1	2	7	1783	223	980	2986
1961	257	134	786	1177	1936	146	387	2469	4	1	2	7	2197	281	1175	3653
1962	276	153	880	1309	2184	178	484	2846	4	2	2	8	2464	333	1366	4163
1963	301	168	973	1442	2559	200	580	3339	4	2	2	8	2864	370	1555	4789
1964	341	179	1070	1590	2905	222	659	3786	4	2	2	8	3250	403	1731	5384
1965	380	192	1197	1769	3117	242	717	4076	4	2	2	8	3501	436	1916	5853
1966	410	209	1317	1936	3226	270	752	4248	4	2	2	8	3640	481	2071	6192
1967	424	230	1395	2049	3288	310	778	4376	4	2	2	8	3716	542	2175	6433
1968	438	237	1487	2162	3330	330	803	4463	4	2	2	8	3772	569	2292	6633
1969	444	244	1584	2272	3388	368	847	4603	4	2	2	8	3836	614	2433	6883
1970	453	256	1661	2370	3432	394	884	4710	4	2	2	8	3889	652	2547	7088
1971	463	262	1755	2480	3468	409	916	4793	4	2	2	8	3935	673	2673	7281
1972	472	279	1859	2610	3530	430	952	4912	4	2	2	8	4006	711	2813	7530
1973	495	306	1963	2764	3611	455	1000	5066	4	2	2	8	4110	763	2965	7838
1974	520	333	2071	2924	3696	472	1049	5217	4	2	4	10	4220	807	3124	8151
1975	546	357	2145	3048	3775	512	1087	5374	4	2	4	10	4325	871	3236	8432
1976	579	406	2226	3211	3847	550	1122	5519	4	2	4	10	4430	958	3352	8740
1977	607	472	2349	3428	3906	585	1148	5639	4	2	4	10	4517	1059	3501	9077
1978	663	596	2499	3758	4007	631	1209	5847	4	4	5	13	4674	1231	3713	9618
1979	745	748	2663	4156	4190	709	1281	6180	5	4	6	15	4940	1461	3950	10351
1980	826	910	2881	4617	4395	806	1351	6552	5	4	6	15	5226	1720	4238	11184
1981	896	1015	3046	4957	4498	874	1427	6799	5	4	6	15	5399	1893	4479	11771
1982	1000	1079	3178	5257	4662	925	1489	7076	5	4	7	16	5667	2008	4674	12349
1983	1102	1117	3313	5532	4888	950	1538	7376	6	4	7	17	5996	2071	4858	12925
1984	1218	1176	3500	5894	5161	988	1598	7747	11	4	8	23	6390	2168	5106	13664
1985	1351	1237	3734	6322	5449	1039	1708	8196	14	4	12	30	6814	2280	5454	14548
1986	1398	1287	3873	6558	5658	1090	1795	8543	16	4	16	36	7072	2381	5684	15137
1987	1491	1330	4058	6879	5871	1138	1879	8888	16	6	18	40	7378	2474	5955	15807
1988	1570	1409	4285	7264	6015	1206	1973	9194	17	6	23	46	7602	2621	6281	16504
1989	1603	1446	4515	7564	6075	1223	2053	9351	19	6	27	52	7697	2675	6595	16967
1990	1603	1446	4531	7580	6076	1223	2062	9361	19	6	27	52	7698	2675	6620	16993
Total	1603	1446	4531	7580	6076	1223	2062	9361	19	6	27	52	7698	2675	6620	16993

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SSCUM003

Cumulative Drilling Statistics
Sweet & Sour - 3000 to 3999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	4	13	17	1	2	10	13	0	0	0	0	1	6	23	30
1951	0	5	17	22	1	5	10	16	0	0	0	0	1	10	27	38
1952	0	7	21	28	1	5	11	17	0	0	0	0	1	12	32	45
1953	1	9	24	34	1	8	11	20	0	0	0	0	2	17	35	54
1954	3	13	36	52	2	8	11	21	0	0	0	0	5	21	47	73
1955	7	17	65	89	3	8	14	25	0	0	0	0	10	25	79	114
1956	9	20	83	112	3	9	15	27	0	0	0	0	12	29	98	139
1957	11	26	106	143	4	11	15	30	0	0	0	0	15	37	121	173
1958	14	36	128	178	21	11	25	57	0	0	0	0	35	47	153	235
1959	17	45	156	218	41	13	39	93	0	0	0	0	58	58	195	311
1960	20	52	176	248	61	23	44	128	0	0	0	0	81	75	220	376
1961	24	59	200	283	68	36	49	153	0	0	0	0	92	95	249	436
1962	27	64	221	312	70	41	56	167	0	0	0	0	97	105	277	479
1963	34	70	246	350	76	46	64	186	0	0	0	0	110	116	310	536
1964	37	80	274	391	80	47	68	195	0	0	0	0	117	127	342	586
1965	40	88	301	429	85	52	73	210	0	0	0	0	125	140	374	639
1966	43	93	323	459	89	61	80	230	0	0	0	0	132	154	403	689
1967	45	102	340	487	94	72	88	254	0	0	0	0	139	174	428	741
1968	47	118	372	537	97	115	99	311	0	0	0	0	144	233	471	848
1969	49	120	406	575	98	147	107	352	0	0	0	0	147	267	513	927
1970	49	122	433	604	98	174	115	387	0	0	0	0	147	296	548	991
1971	49	125	458	632	98	187	125	410	0	0	0	0	147	312	583	1042
1972	52	131	495	678	98	191	126	415	0	0	0	0	150	322	621	1093
1973	55	140	531	726	99	201	128	428	0	0	0	0	154	341	659	1154
1974	57	148	563	768	99	216	134	449	0	0	0	0	156	364	697	1217
1975	60	158	589	807	99	236	137	472	0	0	0	0	159	394	726	1279
1976	67	186	633	886	100	248	144	492	0	0	0	0	167	434	777	1378
1977	74	225	691	990	103	259	149	511	0	0	0	0	177	484	840	1501
1978	95	276	732	1103	106	264	155	525	0	0	0	0	201	540	887	1628
1979	116	345	767	1228	113	270	162	545	0	0	0	0	229	615	929	1773
1980	131	440	821	1392	120	284	169	573	0	0	0	0	251	724	990	1965
1981	144	497	881	1522	121	295	179	595	0	0	0	0	265	792	1060	2117
1982	147	510	928	1585	125	306	181	612	0	0	0	0	272	816	1109	2197
1983	156	521	959	1636	131	321	190	642	0	0	0	0	287	842	1149	2278
1984	161	533	989	1683	134	337	196	667	0	1	0	1	295	871	1185	2351
1985	171	542	1020	1733	142	353	207	702	0	1	1	2	313	896	1228	2437
1986	185	555	1036	1776	149	360	217	726	1	1	1	3	335	916	1254	2505
1987	194	573	1076	1843	157	375	223	755	1	2	1	4	352	950	1300	2602
1988	199	588	1111	1898	166	392	231	789	2	3	1	6	367	983	1343	2693
1989	201	591	1146	1938	168	394	237	799	2	3	1	6	371	988	1384	2743
1990	201	591	1147	1939	168	394	237	799	2	3	1	6	371	988	1385	2744
Total	201	591	1147	1939	168	394	237	799	2	3	1	6	371	988	1385	2744

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SSCUM004

Cumulative Drilling Statistics
Sweet & Sour - 4000 to 4999 m

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	0	0	0	0	0	1	1	2	0	0	0	0	0	1	1	2
1951	0	0	0	0	0	1	1	2	0	0	0	0	0	1	1	2
1952	0	0	0	0	0	1	1	2	0	0	0	0	0	1	1	2
1953	0	0	2	2	0	1	1	2	0	0	0	0	0	1	3	4
1954	0	0	2	2	0	1	1	2	0	0	0	0	0	1	3	4
1955	0	0	3	3	0	1	1	2	0	0	0	0	0	1	4	5
1956	0	1	8	9	0	1	1	2	0	0	0	0	0	2	9	11
1957	0	2	12	14	0	1	2	3	0	0	0	0	0	3	14	17
1958	0	6	15	21	0	1	3	4	0	0	0	0	0	7	18	25
1959	1	8	20	29	0	2	6	8	0	0	0	0	1	10	26	37
1960	2	10	27	39	0	5	10	15	0	0	0	0	2	15	37	54
1961	3	10	33	46	0	5	10	15	0	0	0	0	3	15	43	61
1962	3	10	37	50	0	5	13	18	0	0	0	0	3	15	50	68
1963	3	10	42	55	0	5	13	18	0	0	0	0	3	15	55	73
1964	3	12	49	64	0	5	13	18	0	0	0	0	3	17	62	82
1965	3	13	56	72	0	5	13	18	0	0	0	0	3	18	69	90
1966	3	13	60	76	0	5	13	18	0	0	0	0	3	18	73	94
1967	3	14	61	78	0	6	14	20	0	0	0	0	3	20	75	98
1968	3	18	62	83	0	6	14	20	0	0	0	0	3	24	76	103
1969	5	21	77	103	0	10	15	25	0	0	0	0	5	31	92	128
1970	5	27	105	137	1	11	19	31	0	0	0	0	6	38	124	168
1971	6	29	119	154	1	12	20	33	0	0	0	0	7	41	139	187
1972	6	33	132	171	1	13	21	35	0	0	0	0	7	46	153	206
1973	6	36	142	184	1	14	25	40	0	0	0	0	7	50	167	224
1974	7	40	152	199	1	15	26	42	0	0	0	0	8	55	178	241
1975	7	40	165	212	1	16	27	44	0	0	0	0	8	56	192	256
1976	7	54	175	236	1	18	27	46	0	0	0	0	8	72	202	282
1977	7	79	190	276	1	21	28	50	0	0	0	0	8	100	218	326
1978	7	101	210	318	1	24	29	54	0	0	0	0	8	125	239	372
1979	8	124	236	368	1	26	30	57	0	0	0	0	9	150	266	425
1980	9	152	263	424	1	26	32	59	0	0	0	0	10	178	295	483
1981	9	171	286	466	1	27	34	62	0	0	0	0	10	198	320	528
1982	10	177	299	486	1	27	35	63	0	0	0	0	11	204	334	549
1983	11	177	304	492	1	29	35	65	0	0	0	0	12	206	339	557
1984	11	179	316	506	1	29	35	65	0	0	0	0	12	208	351	571
1985	11	181	323	515	1	32	35	68	0	1	0	1	12	214	358	584
1986	11	185	329	525	1	33	37	71	0	1	0	1	12	219	366	597
1987	11	186	336	533	1	35	40	76	0	1	0	1	12	222	376	610
1988	11	191	350	552	1	38	42	81	0	1	0	1	12	230	392	634
1989	11	191	363	565	1	38	43	82	0	1	1	2	12	230	407	649
1990	11	191	365	567	1	38	43	82	0	1	1	2	12	230	409	651
Total	11	191	365	567	1	38	43	82	0	1	1	2	12	230	409	651

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SSCUM005

Cumulative Drilling Statistics
Sweet & Sour - Total of all Depths

	Exploratory				Development				Other				Total			
Year	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total	Oil	Gas	Other	Total
Pre 1951	71	116	1704	1891	1964	400	1098	3462	1	38	278	317	2036	554	3080	5670
1951	124	179	2005	2308	2645	445	1218	4308	3	41	297	341	2772	665	3520	6957
1952	202	258	2400	2860	3469	511	1443	5423	6	41	313	360	3677	810	4156	8643
1953	275	319	2732	3326	4140	583	1646	6369	9	41	328	378	4424	943	4706	10073
1954	349	368	3016	3733	4711	649	1788	7148	9	43	344	396	5069	1060	5148	11277
1955	422	430	3282	4134	5694	716	1960	8370	13	44	355	412	6129	1190	5597	12916
1956	503	501	3594	4598	6898	775	2128	9801	13	47	391	451	7414	1323	6113	14850
1957	587	571	3977	5135	7628	820	2246	10694	17	53	464	534	8232	1444	6687	16363
1958	643	647	4340	5630	8508	913	2448	11869	17	61	657	735	9168	1621	7445	18234
1959	718	745	4710	6173	9254	1044	2633	12931	17	67	727	811	9989	1856	8070	19915
1960	788	839	5078	6705	10046	1163	2851	14060	17	70	783	870	10851	2072	8712	21635
1961	861	925	5421	7207	10708	1318	3104	15130	17	71	842	930	11586	2314	9367	23267
1962	907	999	5789	7695	11318	1466	3431	16215	17	74	896	987	12242	2539	10116	24897
1963	979	1072	6158	8209	12061	1605	3721	17387	17	75	935	1027	13057	2752	10814	26623
1964	1087	1183	6675	8945	12801	1711	3998	18510	17	78	983	1078	13905	2972	11656	28533
1965	1232	1286	7364	9882	13498	1814	4310	19622	17	82	1020	1119	14747	3182	12694	30623
1966	1327	1385	7998	10710	13996	1930	4547	20473	17	84	1063	1164	15340	3399	13608	32347
1967	1474	1497	8559	11530	14429	2080	4820	21329	17	86	1115	1218	15920	3663	14494	34077
1968	1650	1637	9283	12570	14784	2296	5139	22219	18	90	1187	1295	16452	4023	15609	36084
1969	1789	1750	10075	13614	15055	2563	5450	23068	18	94	1242	1354	16862	4407	16767	38036
1970	1850	1941	10851	14642	15291	2919	5694	23904	18	95	1279	1392	17159	4955	17824	39938
1971	1951	2153	11557	15661	15534	3367	6022	24923	18	97	1321	1436	17503	5617	18900	42020
1972	2015	2437	12424	16876	15950	4071	6380	26401	18	99	1352	1469	17983	6607	20156	44746
1973	2133	2991	13434	18558	16411	4957	6886	28254	19	103	1393	1515	18563	8051	21713	48327
1974	2235	3379	14353	19967	16955	6076	7366	30397	21	103	1413	1537	19211	9558	23132	51901
1975	2321	3862	15185	21368	17563	7386	7801	32750	21	108	1448	1577	19905	11356	24434	55695
1976	2458	4942	16146	23546	18030	9232	8386	35648	22	112	1486	1620	20510	14286	26018	60814
1977	2653	6031	17245	25929	18548	11037	8897	38482	24	113	1517	1654	21225	17181	27659	66065
1978	2877	7066	18404	28347	19205	13021	9499	41725	25	116	1534	1675	22107	20203	29437	71747
1979	3132	7919	19424	30475	20077	15114	10224	45415	26	120	1550	1696	23235	23153	31198	77586
1980	3430	9081	20639	33150	21131	17570	11110	49811	26	121	1565	1712	24587	26772	33314	84673
1981	3725	9884	21916	35525	21925	19310	11939	53174	26	121	1581	1728	25676	29315	35436	90427
1982	4091	10309	22929	37329	22867	20891	12702	56460	26	124	1604	1754	26984	31324	37235	95543
1983	4447	10540	23742	38729	24223	21553	13521	59297	27	124	1610	1761	28697	32217	38873	99787
1984	4936	10890	24856	40682	25903	22357	14772	63032	44	127	1648	1819	30883	33374	41276	105533
1985	5535	11224	26196	42955	27756	23786	16613	68155	55	129	1729	1913	33346	35139	44538	113023
1986	5870	11509	27149	44528	28920	24353	17491	70764	62	132	1767	1961	34852	35994	46407	117253
1987	6319	11849	28261	46429	30381	24847	18612	73840	65	136	1788	1989	36765	36832	48661	122258
1988	6721	12334	29659	48714	31955	25610	20216	77781	72	145	1863	2080	38748	38089	51738	128575
1989	6969	12566	31187	50722	32684	25963	20985	79632	74	147	1896	2117	39727	38676	54068	132471
1990	6979	12572	31365	50916	32695	25970	21121	79786	74	147	1898	2119	39748	38689	54384	132821
Total	6979	12572	31365	50916	32695	25970	21121	79786	74	147	1898	2119	39748	38689	54384	132821

Note: Data is "borehole basis". Excludes test holes, evaluation, experimental and bitumen wells (see DRL04-0/1)
SSCUM006

Table 3.29

CONCORD RISK ANALYSIS

SUMMARY FOR WELLS FINISHED DRILLING FROM 1986 TO 1989

SWEET WELLS

	EXPLORATORY			DEVELOPMENT			SWEET
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	479	1140	1619	4427	596	5023	6642
1001 - 2000	787	813	1600	3187	929	4116	5716
2001 - 3000	244	178	422	866	168	1034	1456
3001 - 4000	17	5	22	42	5	47	69
>4000	2	0	2	0	0	0	2
TOTAL	1529	2136	3665	8522	1698	10220	13885

SOUR WELLS

	EXPLORATORY			DEVELOPMENT			SOUR
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	201	280	481	1318	404	1722	2203
1001 - 2000	658	631	1289	1534	571	2105	3394
2001 - 3000	224	206	430	423	95	518	948
3001 - 4000	99	48	147	80	11	91	238
>4000	28	15	43	17	2	19	62
TOTAL	1210	1180	2390	3372	1083	4455	6845

ALL WELLS

	EXPLORATORY			DEVELOPMENT			ALL
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	680	1420	2100	5745	1000	6745	8845
1001 - 2000	1445	1444	2889	4721	1500	6221	9110
2001 - 3000	468	384	852	1289	263	1552	2404
3001 - 4000	116	53	169	122	16	138	307
>4000	30	15	45	17	2	19	64
TOTAL	2739	3316	6055	11894	2781	14675	20730

CONCORD RISK ANALYSIS

SUMMARY FOR WELLS FINISHED DRILLING IN 1986

SWEET WELLS

	EXPLORATORY			DEVELOPMENT			SWEET
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	105	240	345	1015	188	1203	1548
1001 - 2000	193	235	428	911	266	1177	1605
2001 - 3000	56	34	90	275	41	316	406
3001 - 4000	3	1	4	9	2	11	15
>4000	1	0	1	0	0	0	1
TOTAL	358	510	868	2210	497	2707	3575

SOUR WELLS

	EXPLORATORY			DEVELOPMENT			SOUR
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	10	21	31	161	59	220	251
1001 - 2000	123	86	209	220	68	288	497
2001 - 3000	27	40	67	97	19	116	183
3001 - 4000	25	6	31	20	2	22	53
>4000	6	2	8	4	0	4	12
TOTAL	191	155	346	502	148	650	996

ALL WELLS

	EXPLORATORY			DEVELOPMENT			ALL
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	115	261	376	1176	247	1423	1799
1001 - 2000	316	321	637	1131	334	1465	2102
2001 - 3000	83	74	157	372	60	432	589
3001 - 4000	28	7	35	29	4	33	68
>4000	7	2	9	4	0	4	13
TOTAL	549	665	1214	2712	645	3357	4571

CONCORD RISK ANALYSIS

SUMMARY FOR WELLS FINISHED DRILLING IN 1987

SWEET WELLS

	EXPLORATORY			DEVELOPMENT			SWEET
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	84	185	269	1142	128	1270	1539
1001 - 2000	217	199	416	972	253	1225	1641
2001 - 3000	64	68	132	276	45	321	453
3001 - 4000	6	2	8	20	1	21	29
>4000	1	0	1	0	0	0	1
TOTAL	372	454	826	2410	427	2837	3663

SOUR WELLS

	EXPLORATORY			DEVELOPMENT			SOUR
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	22	58	80	302	109	411	491
1001 - 2000	159	142	301	394	133	527	828
2001 - 3000	42	34	76	109	26	135	211
3001 - 4000	31	14	45	21	2	23	68
>4000	6	1	7	4	1	5	12
TOTAL	260	249	509	830	271	1101	1610

ALL WELLS

	EXPLORATORY			DEVELOPMENT			ALL
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	106	243	349	1444	237	1681	2030
1001 - 2000	376	341	717	1366	386	1752	2469
2001 - 3000	106	102	208	385	71	456	664
3001 - 4000	37	16	53	41	3	44	97
>4000	7	1	8	4	1	5	13
TOTAL	632	703	1335	3240	698	3938	5273

CONCORD RISK ANALYSIS

SUMMARY FOR WELLS FINISHED DRILLING IN 1988

SWEET WELLS

	EXPLORATORY			DEVELOPMENT			SWEET
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	142	370	512	1626	186	1812	2324
1001 - 2000	211	212	423	871	288	1159	1582
2001 - 3000	71	41	112	222	55	277	389
3001 - 4000	1	0	1	10	2	12	13
>4000	0	0	0	0	0	0	0
TOTAL	425	623	1048	2729	531	3260	4308

SOUR WELLS

	EXPLORATORY			DEVELOPMENT			SOUR
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	75	95	170	513	139	652	822
1001 - 2000	184	211	395	547	235	782	1177
2001 - 3000	75	69	144	134	28	162	306
3001 - 4000	24	22	46	28	4	32	78
>4000	9	7	16	7	1	8	24
TOTAL	367	404	771	1229	407	1636	2407

ALL WELLS

	EXPLORATORY			DEVELOPMENT			ALL
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	217	465	682	2139	325	2464	3146
1001 - 2000	395	423	818	1418	523	1941	2759
2001 - 3000	146	110	256	356	83	439	695
3001 - 4000	25	22	47	38	6	44	91
>4000	9	7	16	7	1	8	24
TOTAL	792	1027	1819	3958	938	4896	6715

CONCORD RISK ANALYSIS

SUMMARY FOR WELLS FINISHED DRILLING IN 1989

SWEET WELLS

	EXPLORATORY			DEVELOPMENT			SWEET
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	148	345	493	644	94	738	1231
1001 - 2000	166	167	333	433	122	555	888
2001 - 3000	53	35	88	93	27	120	208
3001 - 4000	7	2	9	3	0	3	12
>4000	0	0	0	0	0	0	0
TOTAL	374	549	923	1173	243	1416	2339

SOUR WELLS

	EXPLORATORY			DEVELOPMENT			SOUR
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	94	106	200	342	97	439	639
1001 - 2000	192	192	384	373	135	508	892
2001 - 3000	80	63	143	83	22	105	248
3001 - 4000	19	6	25	11	3	14	39
>4000	7	5	12	2	0	2	14
TOTAL	392	372	764	811	257	1068	1832

ALL WELLS

	EXPLORATORY			DEVELOPMENT			ALL
TOTAL DEPTH (m)	CASED	NOT CASED	TOTAL	CASED	NOT CASED	TOTAL	TOTAL
0 - 1000	242	451	693	986	191	1177	1870
1001 - 2000	358	359	717	806	257	1063	1780
2001 - 3000	133	98	231	176	49	225	456
3001 - 4000	26	8	34	14	3	17	51
>4000	7	5	12	2	0	2	14
TOTAL	766	921	1687	1984	500	2484	4171

Table 3.30 - Licences Issued with H_2S Anticipated

YEAR	LICENCES ISSUED	H_2S EXPECTED	EXEMPT	TOTAL	EST SOUR	% of LICENCES WHERE H_2S ANTICIPATED (even low H_2S levels)
1984 (Aug-Dec)	3624	598		7178	598	16.5
1985	8763	1468		8763	1468	16.8
1986	4620	1026		4620	1026	22.2
1987	5426	1500	763	5426	1882	34.7
1988	6987	2420	1373	6987	3107	44.7
1989	4500	1892	1009	4500	2397	53.3

It should be noted that a portion of the licenced total will never encounter oil or gas or for that matter H_2S. There are two ways to come up with estimates of % H_2S expected. You can look at the licenced numbers above or finished drilling totals which appear in Table 3.21 and 3.22. The totals for not cased can be assumed to have not encountered H_2S. Figure 3.8 depicts this.

Table 3.31 - Drilling Activity by Year

Conventional Wells Drilled

YEAR	SUCCESSFUL			UNSUCCESSFUL	TOTAL	LICENCES ISSUED
	OIL	GAS	OTHER			
1976	552	3101	80	1272	5037	5410
1977	702	2952	40	1400	5130	5637
1978	944	3090	55	1471	5573	5989
1979	1283	3179	134	1390	5986	6391
1980	1659	3896	229	1876	7660	7820
1981	3056	1475	246	2193	6970	6265
1982	1609	2411	218	1369	5607	5807
1983	2263	1091	324	1060	4738	4395
1984	2356	1281	916	1609	6162	7178
1985	2810	1933	1393	2340	8476	8763
1986	1746	971	409	1383	4509	4620
1987	2176	929	626	1451	5182	5426
1988	2281	1481	863	1992	6617	6987
Total	23437	27790	5533	20806	77647	80688

Notes:

1. Conventional wells does not include oil sands evaluation, experimental, crude bitumen, or commercial crude bitumen wells.

2. Other wells includes service wells such as water injectors, observation wells, and water disposal wells.

3. A successful well is a well which is not abandoned after drilling is complete.

4. Licences issued approximates total drilling activity including oil sands evaluation, experimental, crude bitumen, and commercial crude bitumen wells. This figure does not account for licence cancellations.

Source: ERCB ST 86-17 and ERCB ST 89-17, Alberta Oil & Gas Industry, Annual Statistics

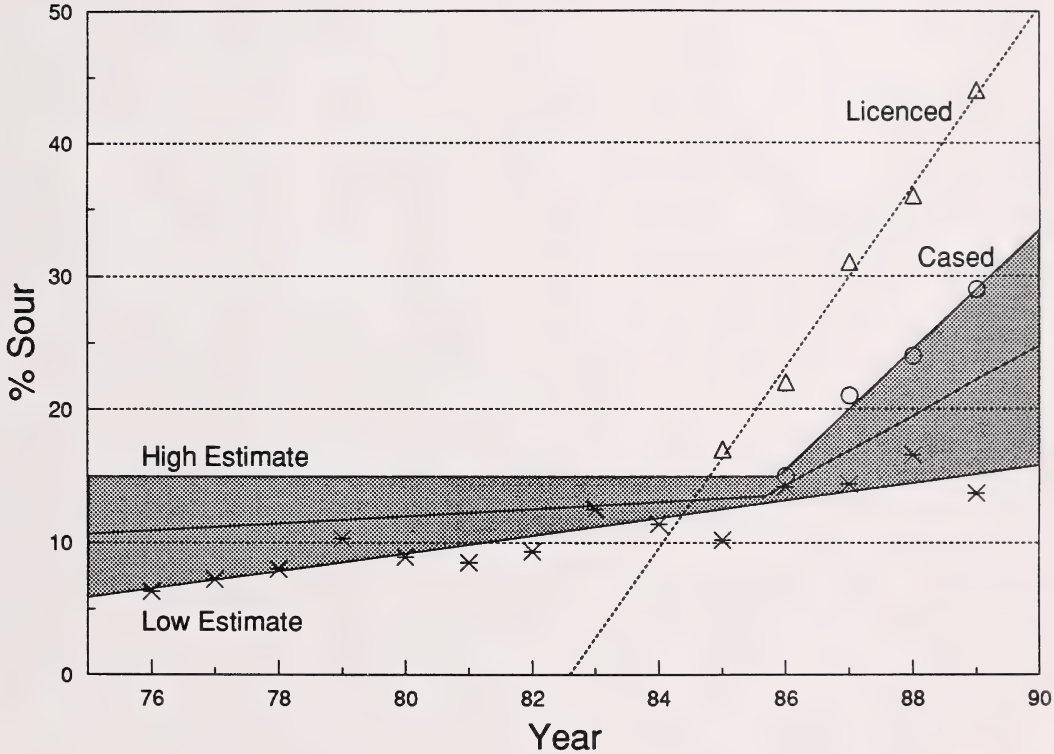


Figure 3.7

Estimates Of Percentage Of Sour Wells Drilled Between 1976 And 1989

Triangle data from Table 3.23
Circle data from Table 3.22
Star data from Table 3.21

4 Blowout and Blow Occurrences for Drilling and Non-Drilling Wells

These tables were supplied by the Drilling and Production Department. The information is contained in ERCB ST 84-46 to ERCB ST 89-46, Oil and Gas Well Blowout Report.

Table 4.1 - Blowout Occurrences

YEAR	DRILLING ALL		NON-DRILLING GAS WELLS		NON-DRILLING OTHER WELLS		TOTAL
	SWEET	SOUR	SWEET	SOUR	SWEET	SOUR	
1975	3	0	0	1	1	1	6
1976	0	0	6	1	1	0	8
1977	4	2	4	1	2	0	13
1978	0	0	7	1	2	1	11
1979	2	0	4	1	4	1	12
1980	2	0	4	1	3	0	10
1981	0	1	4	1	5	1	12
1982	2	1	6	1	2	3	15
1983	0	1	6	0	4	2	13
1984	4	0	2	2	7	0	15
1985	1	0	6	2	10	3	22
1986	2	0	5	1	10	0	18
1987	1	0	5	2	8	0	16
1988	2	0	9	0	5	1	17
TOTAL	23	5	68	15	64	13	188

Note: 1. Gas wells are those wells with a gas status fluid code.

2. Sour wells are those containing any amount of H_2S.

Source: ERCB ST 85-46 to ERCB ST 89-46, Oil and Gas Well Blowout Report

Table 4.2 - Blow Occurrences

YEAR	DRILLING	SERVICING AND OTHER	TOTAL
1975	6	6	12
1976	1	4	5
1977	4	1	5
1978	4	4	8
1979	9	2	11
1980	9	6	15
1981	11	3	14
1982	6	8	14
1983	3	4	7
1984	0	3	3
1985	2	5	7
1986	2	6	8
1987	1	5	6
1988	4	4	8
TOTAL	62	61	123

Note: Prior to 1984, many service and other blows were not recorded.

Source: ERCB ST 85-46 to ERCB ST 89-46, Oil and Gas Well Blowout Report

Table 4.3 - Gas Well Blowouts

YEAR	WELL NO.	SOUR	BLOWOUT DATE	FDRILL DATE	WELL AGE IN YEARS
1988	1	N	JAN 14/88	JAN 9/84	4.00
	2	N	JAN 15/88	MAR 18/81	7.00
	3	N	FEB 4/88	JAN 17/83	5.00
	4	Y	APR 27/88	NOV 1/64	27.50
	5	N	JUL 16/88	FEB 28/84	4.50
	6	N	OCT 17/88	MAY 20/88	0.50
	7	N	OCT 30/88	DEC 16/82	7.00
	8	N	DEC 23/88	FEB 11/67	22.00
	9	N	DEC 31/88	JUL 3/79	9.50
1987	1	N	JAN 3/87	MAR 31/78	9.75
	2	N	JAN 19/87	DEC 23/86	0.00
	3	N	JAN 22/87	MAR 31/80	7.00
	4	Y	MAR 28/87	AUG 7/74	0.50
	5	Y	APR 29/87	MAY 26/76	11.00
	6	N	JUL 23/87	MAR 14/72	22.25
	7	N	SEP 30/87	JUL 14/85	2.00
1986	1	N	JAN 6/86	SEP 10/55	30.25
	2	Y	APR 25/86	AUG 11/85	0.75
	3	N	JAN 27/86	SEP 24/74	11.25
	4	N	AUG 29/86	MAR 7/86	0.50
	5	N	OCT 26/86	DEC 15/76	10.00
	6	N	NOV 26/86	MAR 12/82	0.75
1985	1	N	MAR 3/85	MAR 6/78	7.00
	2	N	MAR 5/85	FEB 2/85	0.00
	3	N	APR 24/85	SEP 4/81	0.50
	4	N	JUN 21/85	AUG 9/76	9.00
	5	N	JUL 19/85	JAN 18/77	8.50
	6	N	AUG 4/85	MAY 6/77	8.00
	7	Y	NOV 19/85	DEC 26/67	18.00
	8	Y	DEC 9/85	APR 14/67	18.25
1984	1	Y	SEP 24/84	APR 9/72	0.50
	2	N	OCT 23/84	AUG 23/84	0.25
	3	N	OCT 26/84	OCT 5/81	3.00
	4	Y	DEC 14/84	APR 8/84	0.75

1983	1	N	FEB 26/83	SEP 10/77	5.50
	2	N	MAY 22/83	DEC 29/82	0.50
	3	N	JUL 18/83	JUN 29/82	1.00
	4	N	SEP 28/83	SEP 3/83	0.00
	5	N	NOV 8/83	MAY 17/52	31.50
	6	N	NOV 21/83	JAN 29/69	15.00
1982	1	N	JAN 28/82	APR 8/75	6.75
	2	N	MAR 15/82	MAR 16/79	3.00
	3	N	APR 11/82	APR 9/75	7.00
	4	N	APR 29/82	NOV 11/58	23.50
	5	N	JUL 14/82	OCT 9/70	11.75
	6	N	SEP 17/82	JAN 20/72	10.75
	7	Y	NOV 20/82	AUG 7/67	15.25
1981	1	N	FEB 1/81	JAN 4/77	4.00
	2	N	JUL 14/81	JUL 25/66	15.00
	3	N	SEP 16/81	FEB 13/75	6.50
	4	Y	NOV 1/81	MAY 13/70	10.50
	5	N	NOV 22/81	AUG 29/77	4.25
1980	1	N	JAN 2/80	OCT 3/75	4.75
	2	N	JAN 9/80	OCT 29/68	11.25
	3	N	JUN 19/80	NOV 4/79	0.50
	4	Y	SEP 10/80	AUG 29/79	1.00
	5	N	OCT 11/80	JAN 10/80	0.75
1979	1	N	MAY 4/79	DEC 1/74	4.50
	2	N	JUN 13/79	NOV 30/78	0.50
	3	N	AUG 27/79	AUG 4/79	0.00
	4	Y	AUG 30/79	AUG 24/64	15.00
	5	N	NOV 23/79	NOV 14/79	0.00
1978	1	Y	JAN 6/78	APR 15/70	8.25
	2	N	JAN 23/78	JUN 9/64	13.50
	3	N	MAR 14/78	FEB 1/78	0.00
	4	N	MAR 18/78	APR 29/73	5.00
	5	N	MAR 22/78	SEP 14/73	4.50
	6	N	NOV 1/78	JAN 20/75	2.75
	7	N	NOV 11/78	FEB 14/61	16.75
	8	N	DEC 7/78	AUG 23/78	0.25
1977	1	N	JAN 19/77	JUL 2/60	16.50

	2	N	JUN 6/77	FEB 24/73	4.25
	3	N	JUN 10/77	MAY 14/51	26.00
	4	N	AUG 10/77	AUG 19/76	1.00
	5	Y	SEP 8/77	APR 12/71	5.75
1976	1	N	FEB 7/76	DEC 5/75	0.25
	2	Y	MAR 21/76	JAN 16/58	18.00
	3	N	MAR 22/76	FEB 11/73	3.00
	4	N	AUG 26/76	AUG 7/52	24.00
	5	N	OCT 15/76	MAY 31/52	24.50
	6	N	NOV 22/76	OCT 22/70	6.00
	7	N	DEC 27/76	MAY 5/70	6.50

TOTAL SWEET WELLS 67 AVERAGE AGE IN YEARS 7.6

TOTAL SOUR WELLS 15 AVERAGE AGE IN YEARS 10

TOTAL WELLS 82 AVERAGE AGE IN YEARS 8

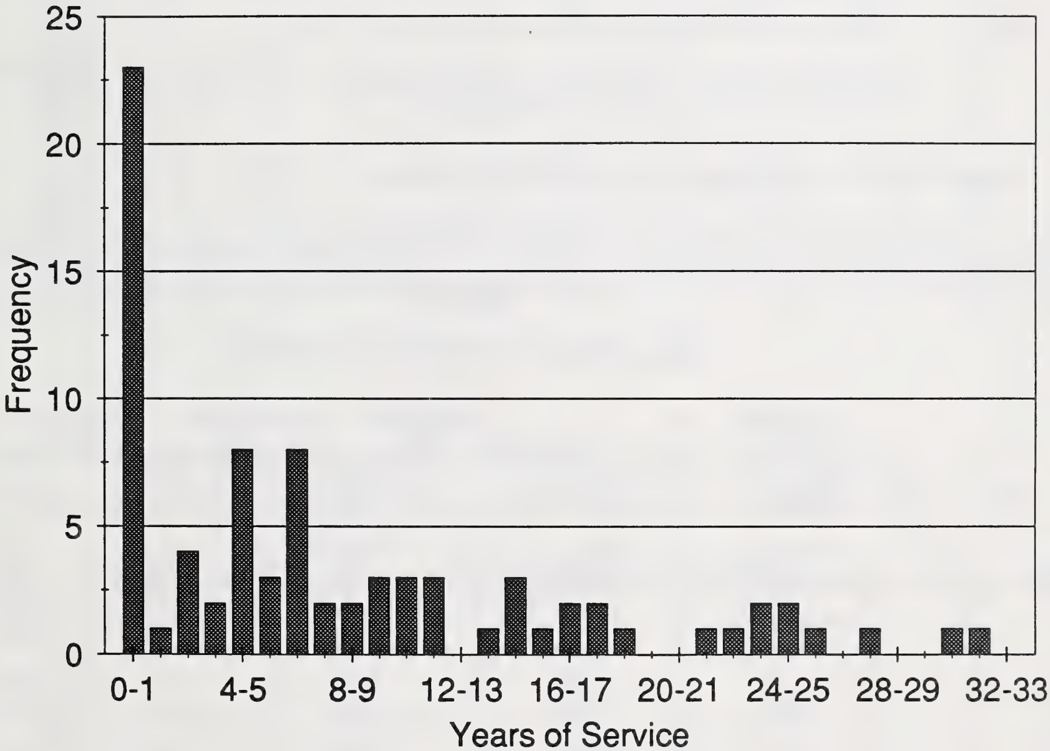


Figure 4.1

Frequency Distribution Of Well Blowouts By Age Of Well.

Table 4.4

Drilling Well Blowout Duration

	MINIMUM (days)	MAXIMUM (days)	AVERAGE (days)
Sweet	0.08	33	5.30
Sour	2.00	67	19.00
All	0.08	67	8.73

Note: 1. Sour Wells are those containing any amount of H_2S.

2. Small population of data must be taken into account when assessing the worthiness of using the averages for statistical analysis.

Source: ERCB ST 86-46, Oil and Gas Well Blowout Report

Table 4.5

Non-drilling Gas Well Blowout Duration

FAILURE CAUSE		MINIMUM (days)	MAXIMUM (days	AVERAGE (days)
Equipment Failure	Sweet	0.50	3.5	1.5
	Sour	0.25	7	2.91
Incorrect Procedure	Sweet	0.25	5	1.56
	Sour	0.50	11	4.10
Environmental Accident	Sweet	0.30	19	9.65
	Sour	N/A	N/A	N/A
Third Party	Sweet	0.08	4	0.99
	Sour	0.02	0.02	0.02
All	Sweet	0.08	19	1.64
	Sour	0.02	11	3.19
	Overall	0.02	19	1.91

Note: 1. Equipment failure encompasses failure by any mechanism, including corrosion.

2. Environmental accident includes failure due to lightning strikes and damage by lake ice.

3. Sour wells are those containing any amount of H_2S.

4. Small population of data must be taken into account when assessing the worthiness of using the averages for statistical analysis.

Source: ERCB ST 86-46, Oil and Gas Blowout Report

Table 4.6

Operation in Progress at the Time of a Drilling Well Blowout Occurrence for the Years 1975 to 1989

	Drill	Circ	Core	Log	Trip In	Trip Out	Run Csg	Test	Other	Total
1975	0	0	0	0	0	3	0	0	0	3
1976	0	0	0	0	0	0	0	0	0	0
1977	1	0	0	0	0	4	1	0	0	6
1978	0	0	0	0	0	0	0	0	0	0
1979	2	0	0	0	0	0	0	0	0	2
1980	2	0	0	0	0	0	0	0	0	2
1981	1	0	0	0	0	0	0	0	0	1
1982	1	1	0	0	0	1	0	0	0	3
1983	0	0	0	0	0	1	0	0	0	1
1984	1	2	0	0	1	0	0	0	0	4
1985	0	0	0	0	0	1	0	0	0	1
1986	1	0	1	0	0	0	0	0	0	2
1987	0	1	0	0	0	0	0	0	0	1
1988	1	0	0	0	0	1	0	0	0	2
1989	1	0	0	1	0	1	0	0	0	3
Total	11	4	1	1	1	12	1	0	0	31
1975-88	10	4	1	0	1	11	1	0	0	28

Table 4.7

Operation in Progress at the Time of a Blow Occurrence for the Years 1975 to 1989

	Drill	Circ	Core	Log	Trip In	Trip Out	Run Csg	Test	Other	Total
1975	3	0	0	0	0	3	0	0	0	6
1976	1	0	0	0	0	0	0	0	0	1
1977	1	1	0	0	1	1	0	0	0	4
1978	0	0	0	0	0	4	0	0	0	4
1979	3	0	1	0	0	6	0	0	0	10
1980	2	0	0	0	0	5	0	0	0	7
1981	4	0	0	0	1	4	0	2	1	12
1982	1	2	0	0	1	2	0	0	0	6
1983	1	0	0	0	0	1	1	0	0	3
1984	0	0	0	0	0	0	0	0	0	0
1985	1	0	0	0	1	0	0	0	0	2
1986	1	0	0	0	0	1	0	0	0	2
1987	1	0	0	0	0	0	0	0	0	1
1988	1	0	0	0	1	1	0	1	0	4
1989	1	0	0	0	1	1	0	0	0	3
Total	21	3	1	0	6	29	1	3	1	65
1975-88	19	3	1	0	4	27	1	2	1	58

Table 4.8

Operation in Progress at the Time of a Kick, Blow or Blowout Occurrence for the Years 1975 to 1989

	Drill	Circ	Core	Log	Trip In	Trip Out	Run Csg	Test	Other	Total
1975	23	6	2	0	1	14	0	2	0	48
1976	42	10	0	0	0	15	1	2	1	71
1977	60	19	9	1	8	30	3	18	0	148
1978	85	29	4	4	11	42	1	21	0	197
1979	128	6	3	3	20	56	5	13	0	234
1980	107	3	9	2	32	120	4	3	1	281
1981	109	5	4	0	27	112	4	8	5	274
1982	54	0	8	0	17	67	0	2	0	148
1983	84	3	8	0	23	62	4	3	1	188
1984	109	2	7	2	34	86	5	4	0	249
1985	132	8	14	1	50	122	12	4	0	343
1986	97	5	5	1	17	93	4	1	0	223
1987	87	4	3	0	33	100	8	2	0	237
1988	122	10	6	4	38	81	7	6	3	277
1989	52	36	2	1	14	75	3	0	1	184
1990	2	1	1	0	0	5	0	0	0	9
Total	1293	147	85	19	325	1080	61	89	12	3111
1975-88	1239	110	82	18	311	1000	58	89	11	2918

Table 4.9

Development Wells.
Depth Drilled (m) at the Time of a Drilling Well Blowout Occurrence for the Years 1975 to 1989.

	0-1000	1001-2000	2001-3000	3001-4000	4001+	Total
1975	0	0	0	0	0	0
1976	0	0	0	0	0	0
1977	1	0	0	0	0	1
1978	0	0	0	0	0	0
1979	0	0	0	0	0	0
1980	1	0	0	0	0	1
1981	0	0	0	0	0	0
1982	1	0	1	0	0	2
1983	0	0	0	0	0	0
1984	0	1	1	0	0	2
1985	0	0	0	0	0	0
1986	2	0	0	0	0	2
1987	1	0	0	0	0	1
1988	1	1	0	0	0	2
1989	1	0	0	0	0	1
Total	8	2	2	0	0	12
1975-88	7	2	2	0	0	11

Table 4.10

Development Wells.
Depth Drilled (m) at the Time of a Drilling Well Blow Occurrence for the Years 1975 to 1989.

	0-1000	1001-2000	2001-3000	3001-4000	4001+	Total
1975	2	2	0	0	0	4
1976	0	0	0	0	0	0
1977	0	2	0	0	0	2
1978	2	2	0	0	0	4
1979	4	2	1	0	0	7
1980	3	2	0	0	0	5
1981	3	0	1	1	0	5
1982	3	1	1	0	0	5
1983	0	2	1	0	0	3
1984	0	0	0	0	0	0
1985	1	0	0	0	0	1
1986	0	0	0	0	0	0
1987	0	0	0	0	0	0
1988	0	1	0	0	0	1
1989	0	0	0	0	0	0
Total	18	14	4	1	0	37
1975-88	18	14	4	1	0	37

Table 4.11

Development Wells.
Depth Drilled (m) at the Time of a Kick, Blow or Blowout Occurrence for the Years 1975 to 1989.

	0-1000	1001-2000	2001-3000	3001-4000	4001+	Total
1975	19	5	3	0	0	27
1976	29	5	3	0	0	37
1977	39	14	3	1	0	57
1978	64	15	2	3	0	84
1979	73	21	11	4	0	109
1980	88	35	14	1	2	140
1981	85	24	15	5	3	132
1982	50	15	15	2	1	83
1983	59	27	24	2	0	112
1984	65	37	28	2	1	133
1985	107	71	31	4	0	213
1986	67	43	28	2	0	140
1987	82	45	19	5	0	151
1988	86	45	28	7	1	167
1989	50	19	9	3	0	81
Total	963	421	233	41	8	1666
1975-88	913	402	224	38	8	1585

Table 4.12

Exploratory Wells.
Depth Drilled (m) at the Time of a Drilling Well Blowout Occurrence for the Years 1975 to 1989.

	0-1000	1001-2000	2001-3000	3001-4000	4001+	Total
1975	2	1	0	0	0	3
1976	0	0	0	0	0	0
1977	3	0	0	2	0	5
1978	0	0	0	0	0	0
1979	1	0	1	0	0	2
1980	1	0	0	0	0	1
1981	0	1	0	0	0	1
1982	0	0	0	0	0	0
1983	0	1	0	1	0	2
1984	1	0	1	0	0	2
1985	1	0	0	0	0	1
1986	0	0	0	0	0	0
1987	0	0	0	0	0	0
1988	0	0	0	0	0	0
1989	1	0	1	0	0	2
Total	10	3	3	3	0	19
1975-88	9	3	2	3	0	17

Table 4.13

Exploratory Wells.
Depth Drilled (m) at the Time of a Drilling Well Blow Occurrence for the Years 1975 to 1989.

	0-1000	1001-2000	2001-3000	3001-4000	4001+	Total
1975	0	1	1	0	0	2
1976	1	0	0	0	0	1
1977	1	0	0	1	0	2
1978	0	0	0	0	0	0
1979	0	1	2	0	0	3
1980	1	1	0	0	0	2
1981	2	2	1	0	2	7
1982	0	0	1	0	0	1
1983	0	0	0	0	0	0
1984	0	0	0	0	0	0
1985	0	1	0	0	0	1
1986	2	0	0	0	0	2
1987	1	0	0	0	0	1
1988	0	2	1	0	0	3
1989	2	0	0	1	0	3
Total	10	8	6	2	2	28
1975-88	8	8	6	1	2	25

Table 4.14

Exploratory Wells.
Depth Drilled (m) at the Time of a Drilling Well Kick, Blow or Blowout Occurrence for the Years 1975 to 1989.

	0-1000	1001-2000	2001-3000	3001-4000	4001+	Total
1975	11	6	4	0	0	21
1976	24	5	5	0	0	34
1977	53	6	14	14	4	91
1978	41	20	29	16	7	113
1979	33	27	29	25	11	125
1980	58	22	27	22	12	141
1981	53	39	20	15	15	142
1982	34	14	10	6	1	65
1983	20	40	11	5	0	76
1984	33	49	25	6	3	116
1985	35	59	27	3	6	130
1986	32	28	10	11	2	83
1987	32	33	11	8	2	86
1988	36	32	28	14	0	110
1989	58	26	11	4	4	103
Total	553	406	261	149	67	1436
1975-88	495	380	250	145	63	1333

Table 4.15

Non-drilling Gas Well Failure Causes.

YEAR	EQUIPMENT FAILURE		INCORRECT PROCEDURE		ENVIRONMENTAL ACCIDENT		THIRD PARTY		TOTAL
	SWEET	SOUR	SWEET	SOUR	SWEET	SOUR	SWEET	SOUR	
1976	3	1	2	0	0	0	1	0	7
1977	1	1	0	0	0	0	3	0	5
1978	5	0	1	1	0	0	1	0	8
1979	2	1	2	0	0	0	0	0	5
1980	2	0	1	1	0	0	1	0	5
1981	2	0	1	1	0	0	1	0	5
1982	1	0	0	1	1	0	4	0	7
1983	2	0	2	0	0	0	2	0	6
1984	1	0	1	1	0	0	0	1	4
1985	2	2	0	0	1	0	3	0	8
1986	2	1	1	0	0	0	2	0	6
1987	1	2	1	0	0	0	3	0	7
1988	6	0	1	0	0	0	2	0	9
TOTAL	30	8	13	5	2	0	23	1	82

Notes: 1. Equipment failure encompasses failure by any mechanism, including corrosion.

2. Environmental accident includes failure due to lightning strikes and damage by lake ice.

3. Sour wells are those containing any amount of H_2S.

4. Non-drilling wells includes producing, and "other" categories of wells as defined on the following pages.

Source: ERCB ST 85-46 to ERCB ST 89-46, Oil and Gas Well Blowout Report

Table 4.16

Producing Sour Gas Well Failure Causes.

YEAR	EQUIPMENT FAILURE	INCORRECT PROCEDURE	ENVIRONMENTAL ACCIDENT	THIRD PARTY	TOTAL
1976	0	0	0	0	0
1977	1	0	0	0	1
1978	0	1	0	0	1
1979	0	0	0	0	0
1980	0	0	0	0	0
1981	0	1	0	0	1
1982	0	1	0	0	1
1983	0	0	0	0	0
1984	0	1	0	0	1
1985	0	0	0	0	0
1986	0	0	0	0	0
1987	2	0	0	0	2
1988	0	0	0	0	0
TOTAL	3	4	0	0	7

Source: ERCB ST 85-46 to ERCB ST 89-46, Oil and Gas Well Blowout Report

Table 4.17

Other Sour Gas Well Failure Causes.

YEAR	EQUIPMENT FAILURE	INCORRECT PROCEDURE	ENVIRONMENTAL ACCIDENT	THIRD PARTY	TOTAL
1976	1	0	0	0	1
1977	0	0	0	0	0
1978	0	0	0	0	0
1979	1	0	0	0	1
1980	0	1	0	0	1
1981	0	0	0	0	0
1982	0	0	0	0	0
1983	0	0	0	0	0
1984	0	0	0	1	1
1985	2	0	0	0	2
1986	1	0	0	0	1
1987	0	0	0	0	0
1988	0	0	0	0	0
TOTAL	5	1	0	1	7

Notes: 1. Equipment failure encompasses failure by any mechanism, including corrosion.

2. Environmental accident includes failure due to lightning strikes and damage by lake ice.

3. Sour wells are those containing any amount of H_2S.

4. Other wells includes suspended, capped, and standing gas wells, as well as gas injection and storage wells.

5. Producing wells includes following wells and wells being serviced.

Source: ERCB ST 85-46 to ERCB ST 89-46, Oil and Gas Well Blowout Report

Table 4.18

Non-drilling Gas Well Operational Mode at Time of Blowout.

YEAR	NORMAL STATUS	SERVICING	TOTAL
1976	4	3	7
1977	4	1	5
1978	5	3	8
1979	2	3	5
1980	3	2	5
1981	3	2	5
1982	7	0	7
1983	4	2	6
1984	2	2	4
1985	6	2	8
1986	4	2	6
1987	6	1	7
1988	6	3	9
TOTAL	56	26	82

Notes:

1. Normal production includes flowing, suspended, capped, and standing gas wells, as well as gas injection and storage wells.

2. Servicing includes both service right and wireline operations.

Table 4.19

Non-drilling Gas Well Blowout Occurrences

YEAR	PRODUCING GAS WELLS SWEET	PRODUCING GAS WELLS SOUR	OTHER GAS WELLS SWEET	OTHER GAS WELLS SOUR	TOTAL
1976	3	0	3	1	7
1977	1	1	3	0	5
1978	3	1	4	0	8
1979	3	0	1	1	5
1980	3	0	1	1	5
1981	2	1	2	0	5
1982	2	1	4	0	7
1983	3	0	3	0	6
1984	2	1	0	1	4
1985	3	0	3	2	8
1986	1	0	4	1	6
1987	2	2	3	0	7
1988	3	0	6	0	9
TOTAL	31	7	37	7	82

Note: 1. Gas wells are those wells with a gas status fluid code.

2. Sour wells are those containing any amount of H_2S.

3. Producing wells includes flowing wells and wells being serviced.

4. Other wells includes suspended, capped, and standing gas wells, as well as gas injection and storage wells.

Source: ERCB ST 85-46 to ERCB ST 89-46, Oil and Gas Well Blowout Report for both tables.

Forward to Table 4.20 Release Details of 22 Blowouts

Some of this information can be found in ERCB ST 86-46, Oil and Gas Well Blowout Report. The data was gathered to review probabilities of release configurations.

A summary outlining 22 of the 23 blowouts is given. For one well, there was insufficient evidence to determine release information. The blowout report for each occurrence was examined to determine:

- The release orientation (vertical or horizontal)
- The release mode (jet or cloud)
- The release rate (103 m3/day)
- Configuration of the release path and release class (up drillpipe, up casing, etc.).

In each case the information obtained relates to the start of the blowout occurrence. It is not always possible to characterize a blowout by a single orientation or mode, because the circumstances surrounding the blowout are constantly evolving. The orientation of the release is based upon its general direction of momentum at the time of the occurrence. The mode gives an indication of the velocity of the release and is influenced by the configuration through which the release escaped. The release rates indicated are based upon estimated losses during the duration of the blowout.

Table 4.20

Release Details of 22 Blowouts.

WELL NAME	DATE	RELEASE DESCRIPTION				
		ORIENTATION	MODE	RATE 10^3 m^3/day	CONFIGURATION	CLASS
GULF POC GOLD RIVER	77/12/20	H	J	40	Blew between casing and hole, out BOP flareline outlet.	4
GAMMA ET AL CESSFORD	77/12/19	V	DJ	56	Blew around surface casing.	6
AMOCO PACIFIC BRAZ RIV	77/12/06	V	DJ	571	Kelly rested on box of pipe deflecting flow. Drillpipe flow only. (Ignited)	1
WESTCOAST AEC SUFFIELD	77/12/04	H	C	57.5	BOP stack sep. from casing flange. Flange leak.	2
DOME LPGS FT SASK	77/03/13	V	DJ	360	Annular would not seal on open hole.	5
SHELL WATERTON	77/02/28	V	J	30-70	Blew through drillpipe bent in derrick.	1
AMOCO ET AL STEEP	79/11/22	V	J	93	Blew through drillpipe after stabbing valve washed out due to damage from closing on wireline.	1
SHELL RANDALL	79/02/26	H	C	N/A	Rubber returns line burst. (Ignited)	2
RENAISSANCE PETMT EDWAND	80/12/01	V	C	190	Blew through split in worn surface casing (Ignited).	2
BLAKE ET AL STEEN	80/02/07	V	DJ	N/A	Blew up annulus. (Ignited).	2
HB SHEKILIE	81/11/18	V	J	400	Blew through drillpipe. (Ignited).	1
AMOCO DOME BRAZ RIV	82/10/17	H	C	2240-3280	Blew through break in bent goose neck lying on ground (Ignited).	1
CAMP TAMERACK LADCO	82/10/14	V	DJ	5	Blew up annulus.	2
CANSTAR CALUMET OV	82/02/11	V	DJ	7	Blew up drill pipe and annulus. (Ignited)	3
DOME SULPETRO VALHALLA	82/01/18	V	DJ	900	Blew up annulus	2
GASCAN ET AL MITSUE	84/07/01	H	C	168	Blew through casing bowl where bull plug had been removed.	4
PCP ET AL PRINCESS	84/06/06	H	C	610	Rubber returns line burst.	2

PEMBINA ET AL FERRIER	84/02/14	V	DJ	313	Blew through collars in stack.	1
DOME ET AL FERRIER	84/02/03	H	C	282	Ignited after washing out manifold and degasser.	2
PCI BITU 5-85-023 OV	85/01/19	V	DJ	N/A	Blew through drillpipe. (Ignited).	1
ESSO 86 J12-3 COLD LAKE	86/12/13	V	C	N/A	Blew to surface outside conductor pipe.	6
DOME ET AL 5A2 LINDBERGH	86/01/14	V	DJ	53	Blew to surface outside conductor pipe.	6

LEGEND

	CLASS	# 0f Occurrences of each Class
H= Horizontal	1 Drillpipe	7
V= Vertical	2 Drillpipe-casing annulus	8
J= Jet	3 Drillipe & Drillpipe - casing annulus	1
DJ= Deflected Jet	4 Casing - Surface Casing Annulus	2
C= Cloud	5 Open Hole	1
	6 Outside of well bore	3

Source:ERCB ST 86-46, Oil and Gas Well Blowout Report

5 Pipeline Failure Statistics

The information in this section is from the Pipeline Department, in the environment information system (EIS) database.

Table 5.1

Area of Rupture Estimation for 7 Ruptures

1985 RECORD #	CAUSE	TYPE	% AREA
5	Third party damage	Branch connection cracked	35
14	Thermal stress	Cracked girth weld	35
15	Thermal stress	Cracked girth weld	35*

1986 RECORD #	CAUSE	TYPE	% AREA
7	Third party damage	Puncture by back-hoe teeth	7
		Open valve	
8	Block valve on tee		50
	failed	Cracked girth weld	
19	Strain due to previous repair		30
	Corrosion in PE lined pipe	Pipe wall thinning	
21		-longitudinal opening	140**

* This percentage estimated by comparing with photography of similar break.

** Area of flow feeding this rupture is limited to 100%.

We have information on other sour gas ruptures but none has the "percentage area" figure calculated.

Table 5.2

Survey of Seven Sour Gas Systems to Determine Some Typical Pipeline Parameters

LOCATION	TOTAL LENGTH (km)	ESD's ON MAIN LINE	ESD's AT WELLS	CHECK VALVES
Coleman	94	11	13	4
Edson	153	4	80	75
Stolberg	62	4	(transmission line only)	
Okotoks	52	12	21	25
Jumping Pd.	140	12	45	15
Crossfield	127	23	64	50
Bashaw	60	7		(transmission line only)
TOTAL	688	73		169

KEY TO CODES USED IN TABLE 5.3

CODE		EXPLANATION
CORROSION	CI	INTERNAL CORROSION
	CW	CORROSION AT GIRTH OR FILLET WELD
	CX	EXTERNAL CORROSION
EXTERNAL FORCES	CD	CONSTRUCTION DAMAGE
	DO	DAMAGE BY OTHERS
	EM	EARTH MOVEMENT
JOINTS	JF	JOINT FAILURE
	MJ	MISCELLANEOUS JOINT FAILURE
WELD	6W	GIRTH WELD FAILURE
	WF	OTHER WELD FAILURE
	SR	SEAM RUPTURE
	IF	INSTALLATION FAILURE
EQUIPMENT	VF	VALVE FAILURE
	PF	PIPE FAILURE
ALL OTHERS	OP	OVER PRESSURE
	OE	OPERATOR ERROR
	MS	MISCELLANEOUS
	UN	UNKNOWN

Table 5.3

Sour Gas Pipeline Ruptures - Time to Failure/Age Analysis

NO.	YY-MM-DD	FIELD	LIC.	LINE	CODE	PRO. LIC/ TEST DATE
1.	75-03-12	Homeglen-Rimbey	10634	016	OP	60
2.	75-04-11	Strachan	13663	020	CI	71-01-02
3.	76-06-12	Rosevear	10300	001	MS	75-11-16
4.	77-11-24	Clive	07293	004	DO	69-09-19
5.	78-02-21	Gold Creek	07670	008	VF	
6.	78-03-19	Garrington	04845	001	CI	64-07-29
7.	78-10-10	Undefined	08237	001	CX	72-01-17
8.	79-09-20	Waterton	16261	001	PF	79-09-27
9.	79-10-03	Stolberg	13995	006	PF	79-09-29
10.	79-10-23	Waterton	16261	003	PF	79-09-27
11.	80-04-22	Turner Valley	03162	012	OP	59-06
12.	81-04-06	Gold Creek	07670	011	PF	80-11-07
13.	81-05-29	Burnt Timber	07768	002	CX	70-07-14
14.	81-11-24	Caroline	06822	001	CI	68-09-21
15.	82-02-28	West Pembina	17909	001	CD	81-04-04
16.	83-01-05	Bellshill Lake	09181	001	DO	74-03-18
17.	83-02-20	Pincher Creek	02572	001	DO	58-10-17
18.	83-03-30	Hanlan	19480	048	PF	82-06-10
19.	83-12-02	Drumheller	19268	002	CI	81-11-25
20.	84-05-07	Stolberg	19787	010	OE	83-03-09
21.	84-11-02	Okotoks	00590	001	PF	
22.	84-06-07	Brazeau River	20586	008	PF	84-03-25 (iv)
23.	84-06-12	Brazeau River	20585	013	PF	84-03-29 (v)
24.	85-03-25	Pine Creek	03348	012	DO	62-04-05
25.	85-03-30	Lonepine Creek	06548	002	CX	67-12-28
26.	85-11-01	Bigstone	06616	016	PF	85-04-25 (vi)
27.	85-11-10	Bigstone	06616	016	PF	85-04-25 (vii)
28.	86-03-17	Drumheller	19268	002	DO	81-11-25
29.	86-03-14	Westerose South	10533	022	VF	60-11-12
30.	86-09-27	Turner Valley	02865	003	GW	61-09-31
31.	86-11-04	Erskine	19124	004	CI	81-11-01
32.	87-12-10	Fenn Big Valley	02697	003	PF	56
33.	88-06-23	Windfall	21120	002	PF	84-10-17
34.	89-03-04	Turner Valley	12640	042	CI	59-06
35.	89-03-19	Meekwap	18979	002	PF	81-05-06

(i) F4 Report indicates pipeline was in service for forty hours.

(ii) Reports indicate pipeline failed within seven days of being put into service.

(iii) F4 comments state that line was being pigged with sweet gas prior to being returned to service. Line failed at 300 kPa.

(iv) Failure analysis and F4 report that pipeline was in operation for three hours.

(v) Failure analysis and F4 report that pipeline was in operation for seven days.

(vi) Reports indicate pipeline had been in service for two days.

(vii) Report states that pipeline (above) was returned to service and failed again in three days.

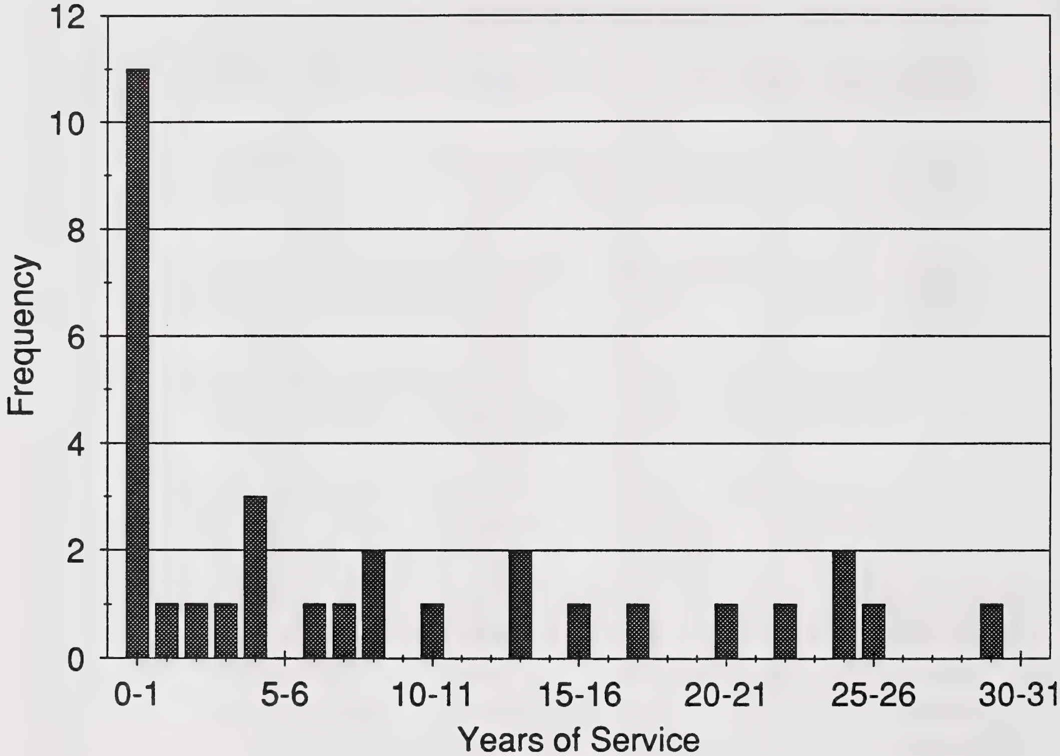


Figure 5.1

Frequency Distribution Of Pipeline Ruptures By Age Of Pipeline.

Table 5.4

SUMMARY OF SOUR GAS (10 MOL/KMOL)
PIPELINE FAILURES
1985-1990 (JUNE)

1985

L/R	% Opening	% H_2S	TEST FAILURE	Diameter	MOP	Area	Cause
L	<1	3.0	--	114.3	103	Redwater	CI
L	<1	8.5	--	168.3	7860	Garrington	CX
L	<1	17.2	--	219.1	9930	Kaybob South	CI
R	<1	13.5	--	88.9	8275	Lone Pine Creek	CI
R	35	31.8	--	88.9	17237	Pine Creek	CX
L	<1	17.8	--	219.1	9930	Kaybob South	DO
L	<1	12.8	--	114.3	8275	Lone Pine Creek	CI
L	<1	13.5	T	114.3	9930	Lone Pine Creek	CI
L	<1	13.5	T	114.3	9930	Lone Pine Creek	CI
L	<1	13.5	T	114.3	9930	Lone Pine Creek	CI
L	<1	1.9	--	114.3	1572	Turner Valley	CX
L	<1	32.8	--	114.3	1390	Crossfield	CI
L	--	14.4	T	114.3	3500	Erskine	CI
R	35	17.0	--	168.3	21680	Fir	GW
R	35	17.0	--	168.3	21680	Fir	GW
L	--	1.9	--	114.3	1570	Turner Valley	JF
L	--	17.8	T	219.1	9930	Kaybob South	CI
L	<1	3.0	--	168.3	1930	Turner Valley	CX
L	<1	--	--	114.3	9930	Kaybob	CI
L	<1	--	--	148.3	8965	Edson	CX

1986

L/R	% Opening	% H_2S	Test Failure	Diameter	MOP	Area	Cause
R	<1	17	T	168.3	11890	Kaybob South	CI
L	<1	14	---	168.3	12410	Windfall	CI
L	<1	14	---	168.3	12410	Windfall	CI
L	<1	14	---	168.3	12410	Windfall	CI
L	<1	14	---	168.3	12410	Windfall	CI
L	<1	14	T	168.3	12410	Windfall	CI
R	7.0	3.7	---	141.2	425	Drumheller	DO
R	50	5.0	---	273.0	7000	Westeose	VF
L	<1	7.6	---	88.9	14400	Rainbow South	CI
L	<1	3.4	---	273.1	8270	Crossfield	CX
L	<1	--	---	114.3	7860	Garlington	CX
L	<1	3.4	---	168.3	1930	Turner Valley	CX
L	<1	0.9	---	168.3	210	Turner Valley	CX
L	<1	1.7	---	273.1	1030	Turner Valley	CI
L	<1	--	---	168.3	9930	Kaybob South	CI
L	<1	17	---	168.3	9000	Kaybob South	CI
L	<1	--	---	168.3	8960	Edson	CX
L	<1	10.8	---	114.3	1380	Malmo	UN
R	30	--	---	168.3	210	Turner Valley	GW
L	<1	--	___	168.3	210	Turner Valley	CX
R	100	--	---	88.9	3500	Erksine	CI
L	<1	0.9	---	168.3	11890	Kaybob South	CX
L	<1	--	---	114.3	8280	Garrington	VF

1987

L/R	% Opening	% H_2S	Test Failure	Diameter	MOP	Area	Cause
L	<1	12.0	---	168.3	8280	Lanaway	CI
L	<1	12.0	---	114.3	8280	Lanaway	CI
L	<1	5.2	---	114.3	11170	Windfall	CI
L	<1	3.5	---	168.3	9930	Pembina	CX
L	<1	--	---	114.3	8270	Crossfield	CX
L	<1	6.6	---	114.3	9930	Kaybob South	CI
L	<1	30	---	114.3	8500	Burnt Timber	CI
L	<1	4.4	---	168.3	4960	Shekilie	CX
L	--	2.3	---	273.1	6650	Other	VF
R	2.5	1.5	---	168.3	4140	Fern Big Valley	PF

1988

L/R	% Opening	% H_2S	Test Failure	Diameter (mm)	MOP (KPa)	Area	Cause
L	<1	2.5	---	114.3	9930	Kaybob	CX
L	<1	5.0	---	114.3	9930	Teepee Creek	CI
L	<1	11.9	---	219.1	9930	Fox Creek	CI
L	<3	14.0	---	168.3	12410	Windfall	PF
L	<1	3	---	323.9	9930	Lookout Butte	CX
L	<1	3	---	323.9	9930	Lookout Butte	CX
L	<1	24.5	---	114.3	17240	Pine Creek	CI
L	<1	24.5	---	114.3	17240	Pine Creek	CI
L	<1	24.5	T	114.3	17240	Pine Creek	UN
L	<1	3.97	T	219.1	4140	Nevis	CX
L	<1	24.5	---	114.3	17240	Pine Creek	CI
L	<1	5.97	T	88.9	4140	Zama	CX
L	<1	17.5	---	114.3	9930	Kaybob South	CX
L	<1	8.5	---	114.3	12200	Resevear	CI
L	<1	17.5	---	114.3	9930	Kaybob South	CI
L	<1	34.0	---	219.1	8270	Crossfield	CX
L	<1	34	---	219.1	8270	Crossfield	CX
L	<1	34	---	219.1	8270	Crossfield	CX
L	<1	34	---	273.1	8270	Crossfield	CX
R	100	34	T	273.1	8270	Crossfield	PF

1989

L/R	% Opening	% H_2S	Test Failure	Diameter (mm)	MOP (kPa)	Area	Cause
L	<1	30	---	273.1	9930	Waterton	CI
L	1.0	9.0	---	114.3	11700	Meekwap	PF
R	19.0	9.0	T	114.3	11700	Meekwap	PF
L	1.0	9.0	T	114.3	11700	Meekwap	PF
L	1.0	9.0	T	114.3	11700	Meekwap	PF
L	4.0	31	---	323.9	13800	Kaybob South	PF
L	1.0	31	---	323.9	13800	OBED	PF
L	5.0	2.0	---	273.1	1350	Turner Valley	CI
L	<1	--	---	60.3	20680	Pincher Creek	CI
L	1.0	9	---	114.3	11030	Meekwap	PF
L	<1	17	---	114.3	9930	Kaybob South	CI
L	1.0	9	---	114.3	11700	Meekwap	PF
L	<1	8	---	219.1	9630	Strachan	CX
L	<1	9	---	114.3	11100	Meekwap	PF
L	<1	17	---	219.1	9930	Kaybob South	CI
L	<1	17	---	219.1	9930	Kaybob South	CI
L	<1	24	---	114.3	17240	Pine Creek	CI
L	<1	4	---	114.3	350	Erskine	CI
L	--	14	T	88.9	3500	Erskine	CI
L	--	24	T	114.3	17240	Pine Creek	CI
L	<1	18.5	---	168.3	13790	Clive	CX
L	<1	35	---	168.3	8300	Okotoks	CI
L	<1	9	T	114.3	11100	Meekwap	PF
L	<1	14	---	88.9	3500	Erskine	CI
L	<1	22	---	114.3	18600	Pine Creek	CX

L	<1	9	T	114.3	11100	Meekwap	PF
L	<1	9	T	114.3	11100	Meekwap	PF
L	<1	14	T	88.9	3500	Erskine	CI
L	<1	1.7	---	168.3	690	Turner Valley	CX

1990 TO JUNE 1990

L/R	% Opening	% H_2S	Test Failure	Diameter (mm)	MOP	Area	Cause
L	<1	4	T	219.1	4140	Stettler	UN
L	<1	17	---	168.3	9930	Kaybob South	CI
L	<1	17	---	273.1	9930	Kaybob South	CI
L	3.0	17	---	168.3	9930	Kaybob South	GW
L	<1	17	---	273.1	9930	Kaybob South	CI
L	<1	6	---	114.3	11890	Kaybob South	PF
L	3.0	17	---	168.3	7000	Rimbey	CI
L	<1	17	---	219.1	8700	Kaybob South	CI
L	<1	2.0	---	273.1	1570	Turner Valley	CI
L	<1	17	---	114.3	11890	Kaybob South	PF
R	100	17	---	114.3	9930	Kaybob South	CX
L	<1	17	T	323.9	11890	Kaybob South	CI
L	<1	2	---	168.3	1570	Turner Valley	CI

TABLE 5.5

LENGTH OF SOUR GAS PIPELINE SERVICE IN ALBERTA

YEAR	NUMBER OF SOUR WELLS (Gas and Gas Condensate)	NUMBER OF KM OF SOUR GAS (4) PIPELINE
1975	826	1 500*
1976	912	1 600
1977	1016	1 800
1978	1101	2 100
1979	1142	2 300
1980	1178	2 500
1981	1267	2 700
1982	1322	2 900
1983	1411	3 000*
1984	1512	3 500*
1985	1640	4 000*
1986	1697	4 400*
1987	1762	4 600*
1988	1828	5 100*
1989	1936	5 500*
Total	N/A	47 500

Notes: Wells > 0.01% H_2S.
Gas pipelines can refer to gas or gas condensate line.
* Estimates from ERCB, others based on regression analysis of km/well with respect to time, using ERCB estimates.

Table 5.6

EIS0420-B ENERGY RESOURCES CONSERVATION BOARD PAGE: 1

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: BU - BUTANE (LIQUID) LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: BU - BUTANE (LIQUID)

RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: CT - CONDENSATE LEAK COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1979	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1980	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
1985	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	3	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	3	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6
LEAK COUNTS :	9	0	3	2	2	0	1	0	0	0	0	0	1	1	0	0	1	0	20

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: CT - CONDENSATE

RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1981	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	3
1982	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
1986	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
RUPTURE COUNTS :	0	0	0	0	7	0	0	0	2	0	0	0	1	0	2	0	0	0	12

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: CO - CRUDE OIL

LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	11	1	7	1	0	0	1	0	1	1	0	2	5	5	0	0	1	2	38
1976	11	1	6	2	0	0	1	0	2	1	0	8	1	1	0	2	1	0	37
1977	8	0	11	1	1	2	1	0	0	0	0	5	0	1	0	0	0	1	31
1978	9	0	2	0	0	0	0	0	0	0	0	0	3	1	0	1	1	1	18
1979	8	0	3	1	2	2	1	0	1	0	1	1	1	1	1	1	0	1	25
1980	17	0	6	4	2	0	1	0	3	0	0	4	0	0	0	0	0	1	38
1981	6	0	2	1	1	0	1	0	2	0	0	2	1	1	0	0	1	0	18
1982	13	0	8	1	1	0	0	0	0	2	0	2	1	0	0	3	2	0	33
1983	8	0	3	2	1	0	1	0	2	0	0	0	1	0	0	0	0	0	18
1984	8	0	6	2	3	0	0	0	1	1	1	2	3	1	0	2	1	0	31
1985	13	0	8	2	3	0	1	0	3	0	1	2	0	0	0	1	1	1	36
1986	5	0	8	0	5	0	0	0	0	1	1	0	3	0	0	3	0	1	27
1987	5	0	6	1	2	0	2	0	1	1	0	1	2	0	0	1	1	0	23
1988	10	0	3	4	2	0	1	0	1	1	0	0	2	1	0	1	0	0	26
1989	18	0	4	1	1	1	0	1	1	0	2	2	4	3	0	0	0	1	39
LEAK COUNTS :	150	2	83	23	24	5	11	1	18	8	6	31	27	15	1	15	9	9	438

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: CO - CRUDE OIL

RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	7	3	0	0	0	0	2	1	1	0	0	0	0	0	14
1976	0	0	0	0	8	0	0	0	0	0	1	0	1	0	1	0	0	0	11
1977	0	0	0	0	6	0	0	0	0	0	1	1	0	1	5	0	0	0	14
1978	0	0	0	0	5	0	0	0	0	0	1	0	0	0	3	0	0	0	9
1979	0	0	0	1	5	1	0	0	0	0	1	0	0	1	2	0	0	0	11
1980	0	0	0	1	12	1	0	0	0	0	1	0	0	2	5	0	0	0	22
1981	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0	5
1982	0	0	0	0	4	0	0	0	0	0	1	0	0	2	4	0	0	0	11
1983	0	0	0	1	3	0	0	0	0	0	0	2	0	0	1	1	0	0	8
1984	0	0	0	1	2	0	0	0	1	0	2	0	2	2	2	0	0	0	12
1985	0	0	0	0	13	0	0	0	0	0	2	0	0	0	13	0	0	1	29
1986	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	5
1987	1	0	0	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	6
1988	0	0	1	0	4	0	0	0	0	0	1	1	1	1	0	0	0	0	9
1989	0	0	0	2	2	0	0	0	2	0	1	0	1	0	0	0	0	0	8
RUPTURE COUNTS :	1	0	2	6	83	5	0	0	3	0	15	5	6	9	37	1	0	1	174

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: DF - DIESEL FUEL

LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
LEAK COUNTS :	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: DF - DIESEL FUEL

RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: ET - ETHANE (LIQUID) LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	4

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: ET - ETHANE (LIQUID)

RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: GS - GASOLINE

LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: GS - GASOLINE

RUPTURE COUNTS

YEAR	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS TOTAL
	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: GL - GLYCOL

LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: GL - GLYCOL

RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: LN - LIQ. NATURAL GAS

LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: LN - LIQ. NATURAL GAS RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: PN - PENTANES LEAK COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: PN - PENTANES

RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: PP - PENTANES PLUS

LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: PP - PENTANES PLUS

RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: PR - PROPANE (LIQUID) LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
1976	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2
1977	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	3
1978	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
1979	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	4
1980	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
LEAK COUNTS :	0	0	4	1	2	2	1	1	0	0	0	1	1	1	0	0	2	1	17

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: PR - PROPANE (LIQUID) RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1978	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1979	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	3
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
1982	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1985	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	9	0	0	0	0	0	0	0	1	0	0	1	0	0	11

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SO - SOUR CRUDE OIL LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1977	2	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	7
1978	2	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	4
1979	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3
1980	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
1983	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1984	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
1985	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	9	0	5	2	2	0	0	0	1	0	1	4	0	1	0	0	0	2	27

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SO - SOUR CRUDE OIL

RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1976	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1977	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	3
1978	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1985	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	1	3	0	0	1	0	0	2	0	1	1	0	0	0	0	9

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SC - SYNTHETIC CRUDE OIL LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	0	4

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: A - LIQUIDS OTHER THAN WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SC - SYNTHETIC CRUDE OIL RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: B - WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: WA - FRESH WATER LEAK COUNTS

YEAR	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	37	4	7	1	0	0	0	0	2	0	1	1	1	10	0	0	2	4	70
1976	60	1	10	4	0	0	0	1	4	4	2	1	2	5	0	0	0	3	97
1977	65	1	1	0	1	1	0	0	1	3	1	0	0	4	1	0	0	2	81
1978	33	0	5	2	0	1	0	0	1	0	0	0	1	2	0	0	2	2	49
1979	48	0	4	4	0	1	0	0	4	0	0	0	1	7	0	0	0	3	72
1980	40	1	8	4	2	0	2	0	2	0	0	0	1	1	0	0	1	3	65
1981	48	0	4	3	1	0	1	0	2	1	1	0	0	3	1	0	2	2	69
1982	32	4	3	1	1	2	0	0	2	1	1	0	0	2	1	0	1	0	51
1983	47	2	6	7	0	3	0	0	1	0	0	0	0	3	0	0	3	4	76
1984	73	0	5	2	0	1	1	0	1	1	4	0	1	0	0	0	1	7	97
1985	100	0	4	1	1	0	2	0	2	0	1	0	0	1	0	0	0	13	125
1986	58	0	2	1	0	2	1	0	0	1	7	0	0	0	1	0	0	1	74
1987	40	0	5	3	0	1	0	0	0	0	1	0	0	1	0	0	0	5	56
1988	51	1	7	3	1	1	0	0	1	0	4	0	1	1	0	0	0	4	75
1989	42	0	1	12	0	0	3	2	0	0	0	0	0	2	0	0	1	0	63
LEAK COUNTS :	774	14	72	48	7	13	10	3	23	11	23	2	8	42	4	0	13	53	1120

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: B - WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: WA - FRESH WATER

RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	1	0	0	0	3	1	0	0	0	0	0	0	0	2	3	1	0	1	12
1976	0	0	0	0	0	0	1	0	0	0	1	0	0	2	0	0	0	0	4
1977	0	0	0	0	2	0	0	0	0	0	2	0	0	1	0	0	0	0	5
1978	0	0	0	0	1	0	0	0	0	0	1	0	1	2	0	0	1	0	6
1979	0	0	0	0	1	0	0	0	0	1	0	0	0	2	0	0	0	0	4
1980	3	0	0	2	1	0	1	0	3	1	4	0	0	2	0	0	0	0	17
1981	0	0	0	0	2	0	0	0	2	0	1	0	0	0	1	0	0	0	6
1982	1	0	0	0	0	1	0	0	0	0	6	0	0	0	3	0	0	0	11
1983	4	0	0	1	1	1	0	0	0	0	10	0	0	1	1	0	0	0	19
1984	1	0	0	0	2	1	1	0	0	0	11	0	0	0	0	0	0	0	16
1985	3	0	0	0	3	0	0	0	0	0	10	0	0	1	4	0	0	0	21
1986	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	4
1987	1	0	0	1	1	0	0	0	0	0	1	0	0	0	1	0	0	0	5
1988	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3
1989	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3
RUPTURE COUNTS :	15	0	0	5	17	4	3	0	5	2	52	0	1	13	16	1	1	1	136

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: B - WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SW - SALT WATER LEAK COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	19	9	6	5	0	0	4	0	1	1	3	1	1	3	0	0	1	3	57
1976	49	7	8	10	1	0	0	0	0	0	6	2	2	8	0	0	3	2	98
1977	33	10	6	6	0	0	1	0	3	4	3	3	2	8	0	0	1	3	83
1978	32	6	10	3	1	0	2	0	5	0	12	2	2	5	0	1	2	4	87
1979	38	3	1	6	2	1	3	0	1	0	0	0	3	4	3	0	2	1	68
1980	68	2	7	15	3	0	1	0	2	0	1	0	2	3	0	0	1	1	106
1981	63	11	6	7	2	0	6	1	0	3	4	0	0	2	0	0	1	1	107
1982	71	4	6	5	0	0	6	1	1	3	2	0	1	3	1	0	2	4	110
1983	112	7	7	8	1	2	7	0	3	0	2	0	3	5	2	0	2	4	165
1984	101	7	9	19	4	0	6	4	2	1	10	0	3	12	1	0	3	2	184
1985	172	13	11	19	3	2	10	2	1	1	3	1	2	2	1	0	4	4	251
1986	175	7	5	17	1	1	6	6	2	2	5	1	0	7	0	1	5	20	261
1987	205	21	9	16	0	1	8	2	4	1	5	0	6	2	0	1	4	12	297
1988	287	0	11	9	0	3	5	1	2	7	4	0	1	3	1	2	2	14	352
1989	262	2	7	13	2	2	3	1	5	6	1	0	8	13	0	0	1	19	345
LEAK COUNTS :	1687	109	109	158	20	12	68	18	32	29	61	10	36	80	9	5	34	94	2571

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: B - WATER * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SW - SALT WATER

RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	1	0	1	0	0	0	2	0	1	2	1	0	0	0	8
1976	0	1	0	0	1	0	0	0	0	0	1	0	0	0	2	0	0	1	6
1977	0	0	0	0	2	1	0	0	0	0	0	0	0	2	6	0	0	0	11
1978	0	0	0	2	0	0	0	0	0	0	2	0	0	1	4	0	3	0	12
1979	1	0	0	2	0	0	0	0	2	0	2	0	0	2	2	1	0	0	12
1980	0	0	0	0	0	0	0	1	1	0	9	0	0	3	5	0	0	0	19
1981	1	0	0	3	0	1	2	0	3	2	3	0	0	4	2	0	0	0	21
1982	10	0	0	1	3	0	0	0	0	0	4	0	0	2	0	0	0	0	20
1983	3	0	0	2	1	0	1	1	0	0	1	0	0	5	1	0	0	0	15
1984	5	0	1	2	5	1	1	0	3	1	7	1	1	2	0	0	0	0	30
1985	3	3	0	2	3	0	1	0	1	0	6	0	1	0	0	0	0	1	21
1986	16	0	0	1	1	0	4	0	0	0	10	0	0	2	0	0	3	0	37
1987	8	0	0	1	3	0	0	0	0	2	5	1	0	1	2	0	0	0	23
1988	6	0	0	5	4	0	1	1	0	1	9	0	1	2	2	0	0	0	32
1989	3	0	0	2	0	0	0	1	1	0	0	0	0	6	3	0	0	0	16
RUPTURE COUNTS :	56	4	1	23	24	3	11	4	11	6	61	2	4	34	30	1	6	2	283

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: C - MULTIPHASE FLUIDS * FOR THE YEARS 1975 THRU 1989 *

SOURCE: M2 - SOUR MULTIPHASE LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
1976	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1977	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1980	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	2	6
1981	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	4
1982	5	0	7	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	15
1983	5	0	6	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	15
1984	2	0	8	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	13
1985	5	0	2	0	2	0	0	1	2	0	0	0	0	0	1	0	0	1	14
1986	10	0	7	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	20
1987	8	0	4	2	1	0	2	0	0	0	0	0	0	1	1	0	1	1	21
1988	16	0	2	3	1	0	0	0	1	0	0	0	0	1	0	0	0	1	25
1989	25	0	6	0	1	0	1	0	0	1	0	0	1	0	1	0	1	2	39
LEAK COUNTS :	83	1	46	7	9	3	5	1	7	2	1	0	1	2	4	1	3	9	185

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: C - MULTIPHASE FLUIDS * FOR THE YEARS 1975 THRU 1989 *

SOURCE: M2 - SOUR MULTIPHASE

RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
1980	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	4
1981	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	1	0	0	5
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	3
1984	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1985	0	0	0	0	2	0	0	0	2	1	0	0	0	1	0	0	0	0	6
1986	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	3
1987	0	0	0	1	2	0	0	1	0	0	1	0	0	2	1	0	1	0	9
1988	0	0	0	0	4	0	0	0	0	0	0	0	2	0	1	0	0	0	7
1989	0	0	2	1	3	0	0	0	0	0	0	0	0	0	1	1	1	0	9
RUPTURE COUNTS :	0	0	2	3	18	0	0	1	3	1	1	0	2	7	9	3	2	0	52

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: C - MULTIPHASE FLUIDS * FOR THE YEARS 1975 THRU 1989 *

SOURCE: M1 - SWEET MULTIPHASE LEAK COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	23	4	51	7	1	1	3	0	3	2	1	3	5	15	5	0	7	10	141
1976	17	2	41	5	1	4	1	0	4	0	3	2	0	2	0	2	2	5	91
1977	35	2	40	7	3	0	1	0	7	1	0	2	0	2	1	1	4	11	117
1978	38	1	45	5	4	0	3	1	5	0	4	1	2	5	0	0	5	9	128
1979	40	0	44	4	6	2	1	1	6	0	0	0	2	12	5	3	8	3	137
1980	39	2	41	5	7	1	5	1	3	0	1	0	0	3	5	3	0	3	119
1981	61	2	58	6	3	2	6	0	5	3	3	0	2	5	8	0	3	1	168
1982	60	1	45	9	7	0	4	3	2	0	1	0	1	1	6	0	2	7	149
1983	67	0	41	2	10	1	4	0	5	0	0	0	0	1	1	2	2	2	138
1984	71	0	34	9	3	1	7	2	2	0	0	0	1	0	6	0	6	0	142
1985	75	2	72	9	8	6	6	4	6	2	2	1	0	1	5	1	6	5	211
1986	81	0	54	11	5	1	4	2	2	3	0	0	2	2	7	5	1	3	183
1987	96	3	59	4	12	0	4	1	2	0	3	1	2	0	4	1	1	1	194
1988	102	2	54	8	7	2	0	3	2	2	2	0	0	2	9	0	4	3	202
1989	96	0	42	3	8	3	6	4	7	0	0	0	4	4	6	0	2	3	188
LEAK COUNTS :	901	21	721	94	85	24	55	22	61	13	20	10	21	55	68	18	53	66	2308

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: C - MULTIPHASE FLUIDS * FOR THE YEARS 1975 THRU 1989 *

SOURCE: M1 - SWEET MULTIPHASE RUPTURE COUNTS

YEAR	CORROSION CI	CORROSION CW	CORROSION CX	EXTNL FORCES CD	EXTNL FORCES DO	EXTNL FORCES EM	JOINTS JF	JOINTS MJ	WELD GW	WELD WF	WELD SR	EQUIPMENT IF	EQUIPMENT VF	ALL OTHER FAILURES PF	ALL OTHER FAILURES OP	ALL OTHER FAILURES OE	ALL OTHER FAILURES MS	ALL OTHER FAILURES UN	CROSS TOTAL
1975	0	0	0	1	9	2	0	0	1	0	0	1	0	2	14	0	0	0	30
1976	0	0	0	1	10	1	0	0	0	0	2	2	0	1	5	0	0	0	22
1977	0	0	0	1	8	1	0	0	0	0	0	0	0	5	7	0	1	1	24
1978	0	0	1	1	18	0	0	0	1	0	2	0	2	1	10	1	2	0	39
1979	0	0	0	2	2	0	0	0	2	0	0	0	0	1	5	3	0	0	15
1980	0	0	1	3	10	2	0	0	2	0	2	0	0	4	12	0	2	1	39
1981	1	0	2	4	14	1	1	0	1	0	1	0	1	2	10	3	0	1	42
1982	0	0	1	7	15	2	0	0	1	1	1	0	0	5	16	2	1	0	52
1983	1	0	1	0	12	2	0	0	1	0	3	0	0	0	9	1	0	0	30
1984	0	0	2	4	29	1	1	1	1	0	2	0	0	2	15	1	1	1	61
1985	2	0	5	1	19	1	1	0	0	0	1	0	0	2	12	1	1	0	46
1986	3	0	5	0	8	2	0	0	0	0	1	0	1	0	8	1	0	0	29
1987	4	0	2	1	4	4	0	0	0	0	2	0	0	2	9	0	0	0	28
1988	2	0	1	0	13	3	0	0	0	0	1	0	0	3	11	1	0	0	35
1989	3	0	4	1	10	0	0	1	0	0	2	0	0	0	3	0	0	0	24
RUPTURE COUNTS :	16	0	25	27	181	22	3	2	10	1	20	3	4	30	146	14	8	4	516

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: D - GASES OTHER THAN SOUR * FOR THE YEARS 1975 THRU 1989 *

SOURCE: AR - AIR (GASEOUS) LEAK COUNTS

YEAR	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS TOTAL
	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1981	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: D - GASES OTHER THAN SOUR * FOR THE YEARS 1975 THRU 1989 *

SOURCE: AR - AIR (GASEOUS) RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: D - GASES OTHER THAN SOUR * FOR THE YEARS 1975 THRU 1989 *

SOURCE: FG - FUEL GAS

LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	3
1976	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
1978	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
1979	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1980	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
1981	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	1	0	4
1982	0	0	1	1	1	0	0	2	0	2	0	0	1	2	0	0	0	0	10
1983	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1984	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3
1985	2	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	5
1986	0	0	1	0	0	0	2	0	0	1	0	0	0	0	1	0	1	0	6
1987	3	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	5
1988	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
1989	0	0	1	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	5
LEAK COUNTS :	6	0	6	5	3	2	5	5	3	3	0	1	1	7	1	0	5	0	53

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: D - GASES OTHER THAN SOUR * FOR THE YEARS 1975 THRU 1989 *

SOURCE: FG - FUEL GAS

RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1982	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	1	0	5
1983	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1984	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1987	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	4
1988	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1989	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
RUPTURE COUNTS :	0	0	0	1	19	0	0	0	0	0	0	0	0	0	0	0	2	0	22

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: D - GASES OTHER THAN SOUR * FOR THE YEARS 1975 THRU 1989 *

SOURCE: NG - NATURAL GAS LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	5	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	9
1976	6	0	6	2	5	0	0	0	1	3	0	2	1	4	0	0	0	1	31
1977	4	1	3	2	1	0	0	1	0	0	3	1	1	0	0	0	0	2	19
1978	1	0	9	3	1	0	0	0	2	0	0	1	0	4	0	0	4	1	26
1979	3	0	8	1	8	0	26	0	3	1	1	0	3	7	0	0	3	1	65
1980	10	0	8	0	5	0	0	0	2	0	1	0	2	2	0	0	0	2	32
1981	4	0	18	4	2	1	1	0	3	3	0	0	1	2	0	0	1	0	40
1982	5	0	22	3	6	1	1	0	4	2	0	0	1	3	0	0	1	2	51
1983	13	0	12	0	1	0	5	1	3	3	1	0	1	1	0	0	1	0	42
1984	10	0	12	4	6	0	1	0	5	0	2	0	0	1	0	0	0	0	41
1985	14	0	15	3	3	1	0	0	3	1	1	0	1	4	0	0	1	1	48
1986	18	0	30	5	1	0	0	0	1	2	0	0	0	3	0	0	2	0	62
1987	14	0	28	0	10	1	4	0	3	1	1	0	2	1	0	1	4	8	78
1988	24	3	22	8	8	1	2	1	3	4	2	0	15	4	0	1	0	1	99
1989	35	0	23	2	9	1	1	0	6	1	0	0	3	3	4	1	0	2	91
LEAK COUNTS :	161	4	221	39	67	7	41	3	39	21	12	4	31	39	4	3	17	21	734

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: D - GASES OTHER THAN SOUR * FOR THE YEARS 1975 THRU 1989 *

SOURCE: NG - NATURAL GAS

RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS			WELD		EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	1	0	9	1	0	0	0	0	0	1	0	1	2	0	0	0	15
1976	0	0	0	0	15	1	0	0	1	1	0	0	0	3	1	0	0	0	22
1977	1	0	0	0	17	1	0	0	1	0	0	0	0	1	0	0	1	0	22
1978	0	0	1	0	11	0	1	0	0	1	0	0	0	1	0	0	0	1	16
1979	0	0	0	6	18	2	0	0	0	0	0	0	1	0	1	0	0	0	28
1980	0	0	1	0	27	6	0	0	0	0	0	0	0	2	1	0	0	0	37
1981	1	0	0	2	18	0	0	0	0	0	0	0	0	0	1	0	1	0	23
1982	3	0	1	1	23	0	1	0	0	0	0	1	0	2	0	0	0	0	32
1983	1	0	0	0	17	1	0	0	1	0	0	0	1	2	1	0	0	0	24
1984	0	0	0	0	17	0	0	1	0	0	0	0	0	1	0	0	0	1	20
1985	0	0	2	3	26	1	0	0	0	0	0	0	0	0	1	0	0	0	33
1986	2	0	3	2	20	3	0	0	0	4	0	0	0	1	0	0	0	0	35
1987	0	0	2	1	16	0	0	0	0	0	0	0	0	0	0	1	2	0	22
1988	1	0	0	1	16	0	1	0	1	0	0	0	0	0	0	0	2	0	22
1989	0	0	1	3	22	1	0	0	1	0	0	0	0	2	0	0	1	1	32
RUPTURE COUNTS :	9	0	12	19	272	17	3	1	5	6	0	2	2	16	8	1	7	3	383

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PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: D - GASES OTHER THAN SOUR * FOR THE YEARS 1975 THRU 1989 *

SOURCE: ST - STEAM

LEAK COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: D - GASES OTHER THAN SOUR * FOR THE YEARS 1975 THRU 1989 *

SOURCE: ST - STEAM

RUPTURE COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: E - SOUR GASES * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SF - SOUR FUEL GAS LEAK COUNTS

	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
YEAR	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1978	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEAK COUNTS :	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: E - SOUR GASES * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SF - SOUR FUEL GAS

RUPTURE COUNTS

YEAR	CORROSION			EXTNL FORCES			JOINTS		WELD			EQUIPMENT		ALL OTHER FAILURES					CROSS
	CI	CW	CX	CD	DO	EM	JF	MJ	GW	WF	SR	IF	VF	PF	OP	OE	MS	UN	TOTAL
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUPTURE COUNTS :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

RUN DATE: 04 JUN 1990 ENVIRONMENT INFORMATION SYSTEM DATA DATE: 01 JUN 1990

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: E - SOUR GASES * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SG - SOUR NATURAL GAS LEAK COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	21	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	27
1976	7	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	10
1977	8	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	11
1978	5	0	4	1	0	0	0	0	2	0	0	0	0	2	0	0	0	0	14
1979	14	0	6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	21
1980	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	6
1981	4	0	2	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	8
1982	5	0	9	0	0	1	3	0	5	0	0	0	0	0	0	0	0	0	23
1983	6	0	1	1	0	0	0	0	2	1	0	0	0	0	0	0	0	0	11
1984	11	0	4	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	19
1985	14	0	5	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	21
1986	9	0	7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	18
1987	7	0	3	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	12
1988	7	0	10	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	19
1989	12	0	4	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	25
LEAK COUNTS :	135	1	58	3	1	2	5	0	16	2	0	1	2	14	0	0	1	4	245

PIPELINE - GAS AND LIQUID RELEASES

SUMMARY OF FAILURES BY SOURCE WITHIN CATEGORY

CATEGORY: E - SOUR GASES * FOR THE YEARS 1975 THRU 1989 *

SOURCE: SG - SOUR NATURAL GAS RUPTURE COUNTS

YEAR	CORROSION CI	CW	CX	EXTNL FORCES CD	DO	EM	JOINTS JF	MJ	WELD GW	WF	SR	EQUIPMENT IF	VF	ALL OTHER FAILURES PF	OP	OE	MS	UN	CROSS TOTAL
1975	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
1977	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1978	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3
1979	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	4
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
1981	3	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5
1982	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1983	1	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	4
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	4
1985	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	4
1986	2	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	5
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1989	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3
RUPTURE COUNTS :	9	0	4	1	5	0	0	0	2	0	0	0	2	13	2	1	1	0	40

Appendix B

Toxicological Justification of the Triple Shifted Rijnmond Equation

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April 1990

ERCB Technical Paper

Toxicological Justification of the Triple Shifted Rijnmond Equation

The GASRISK model uses probit analysis to estimate the probability of lethality of H_2S in a population of humans. This method was determined by Concord Scientific Corporation (CSC) as being the simplest way of incorporating existing toxicological data into the computational model. By this method, the probit function relates population response to the inhaled dose of H_2S. The latter parameter is calculated using the concept of "toxic load" as defined by Equation 1 below:

$$L = \chi^n \cdot t_E \qquad (1)$$

where	L	= toxic load (units = $ppm^n \cdot$ min)
	χ	= H_2S concentration (units = ppm)
	t_E	= exposure time
	n	= constant exponent (usually > 1.0)

The toxicological outcome of the combination of χ^n and t_E is non-linear with the value of n ranging from 2.0 - 3.0 for a variety of toxic gases including H_2S (ten berge *et al*, 1986).

In biological populations, the probability of a severe adverse effect such as lethality is assumed to be log-normally distributed. This is created by the differential susceptibility of individuals within the population, i.e. some are very sensitive to the same toxic load while others are very resistant. The corresponding probit function defining this phenomena is given in Equation 2.

$$Y = k_2 l_n(L) + k_1 \qquad (2)$$

In order to employ the probit approach to estimate probability of lethality, values for k_1, k_2 and n must be derived from the toxicological literature. CSC undertook a limited review of existing toxicological information on humans and animals in order to derive these variables. From this analysis, the Triple-Shifted Rijnmond equation was generated by CSC. Using the values of k_1 = -36.2, k_2 = 2.366 and n = 2.5, CSC then calculated fatal H_2S concentrations (ppm) for selected exposure times. Their data is presented in Table 5.4 of their report.

A more extensive review was undertaken by Dr. R. Rogers of known cases of animal and human lethality in the H_2S literature. The results of this study (summarized in Figures B-1, B-2, B-3, Table B-1 and B-2) clearly validate CSC's conclusion that the Triple-Shifted Rijnmond equation more accurately fits human and animal lethality data reported in the literature.

An examination of the family of curves for different species in Figure B-1 reveals that different species vary in their sensitivity to lethal concentration-time combinations of H_2S exposure. Birds (e.g. canaries, doves) appear to be the most sensitive species while mice, rats, guinea pigs, dogs and goats are more resistant. In fact, the data suggests that these species respond very similarly to different concentration-time concentrations, i.e. there is no clear separation of curves for each species. The experience for man is more variable as evidenced by the greater scatter of the data points. For all species, however, there is a general sigmoidal distribution on the log-log plot of exposure of time versus concentration.

The curves illustrate that lower concentrations of H_2S will produce lethality at long exposure times while high concentrations of H_2S will produce lethality in short periods of time for all species. This general relationship implies that H_2S is affecting the physiological response of each species in a similar fashion, perhaps through the inhibition of cytochrome oxidase.

In Figure B-2, the probit plots have been overlaid on the original data. An examination of the original L_{50} Rijnmond plot suggests that an H_2S concentration of 1000 ppm would require an exposure time of approximately 12 minutes to produce lethality in 50 percent of the exposed population. For the Triple-Shifted Rijnmond plot, this same concentration would require only 1.5 minutes to produce lethality. Experience with acute H_2S exposures in the oil and gas industry within Alberta suggests that exposure to levels of H_2S at 1000 ppm is rapidly fatal. Thus, the Triple-Shifted curve appears to more accurately reflect human experience in Alberta. A comparison of the original Rijnmond plot to the Triple-Shifted plot suggests that the latter is more conservative in its prediction of lethality. This is best understood if one notes that at exposure times greater than 5 minutes, most of the data points fall to the right of the Triple-Shifted plot, i.e. this plot will predict lethality when the data would suggest that minimal lethality would occur. This leads to the conclusion that long exposures (e.g. > 3 hr) appear to be safe by a factor of 2 with respect to the H_2S concentration.

The fact that the Triple-Shifted L_{50} curve lies close to the canary curve suggests that in order for this curve to be applicable to the human situation, humans would have to be as sensitive to H_2S as canaries. This clearly is unlikely for the average individual. But what about the so-called hypersusceptibles within the population, i.e. asthmatics, the elderly and those with severe respiratory disease? In this case, the Triple-Shifted curve is probably a more accurate predictor of their response.

One other factor that appears to have a direct bearing on the selection of the most appropriate probit plot is the level of activity of the individuals. Withers and Lees (1985).

Figure B-3 is an enlargement of the more congested portion of the data set. It shows certain data points more clearly.

FIGURE B-1

TOXIC LOAD - HYDROGEN SULPHIDE

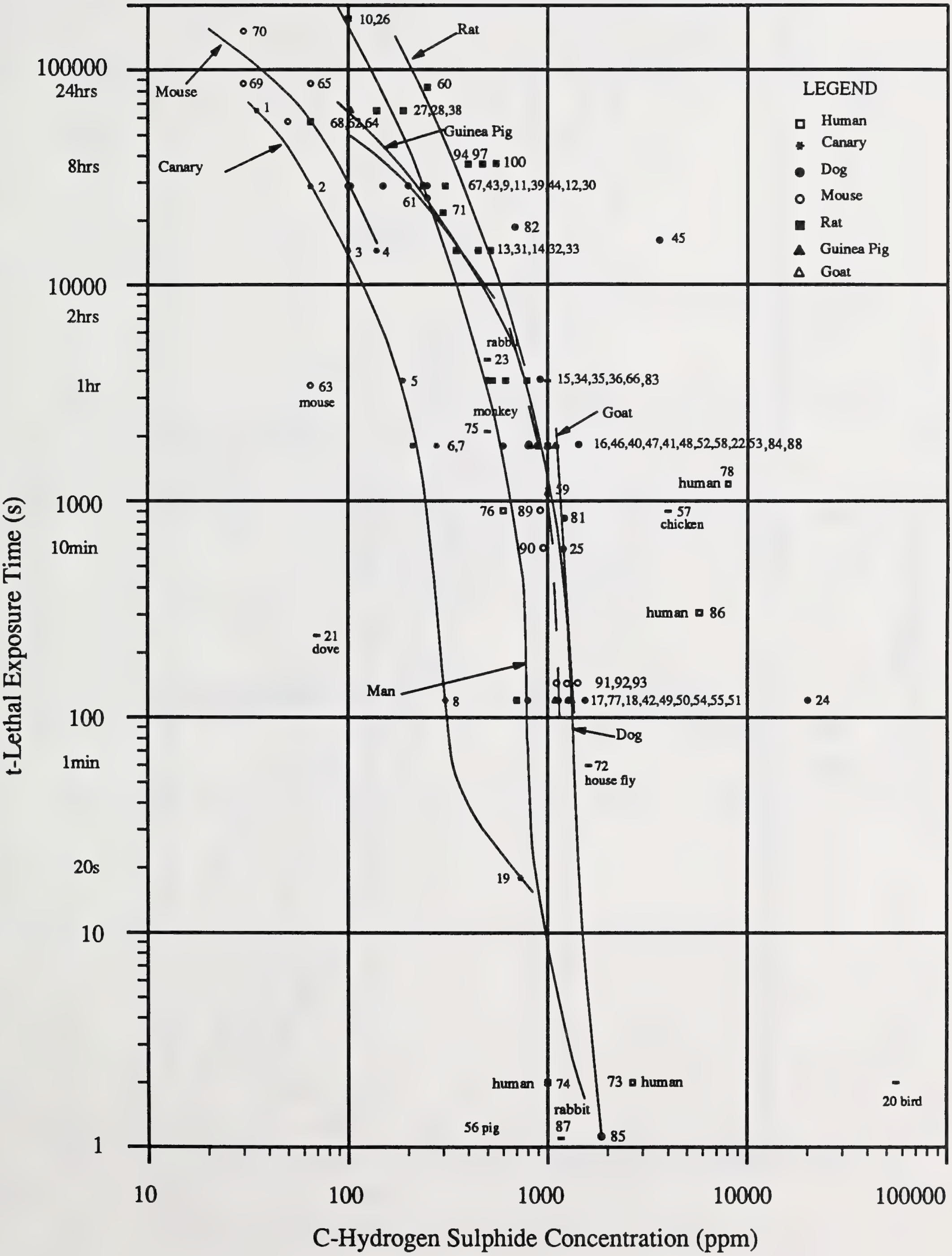

FIGURE B-2

TOXIC LOAD - HYDROGEN SULPHIDE

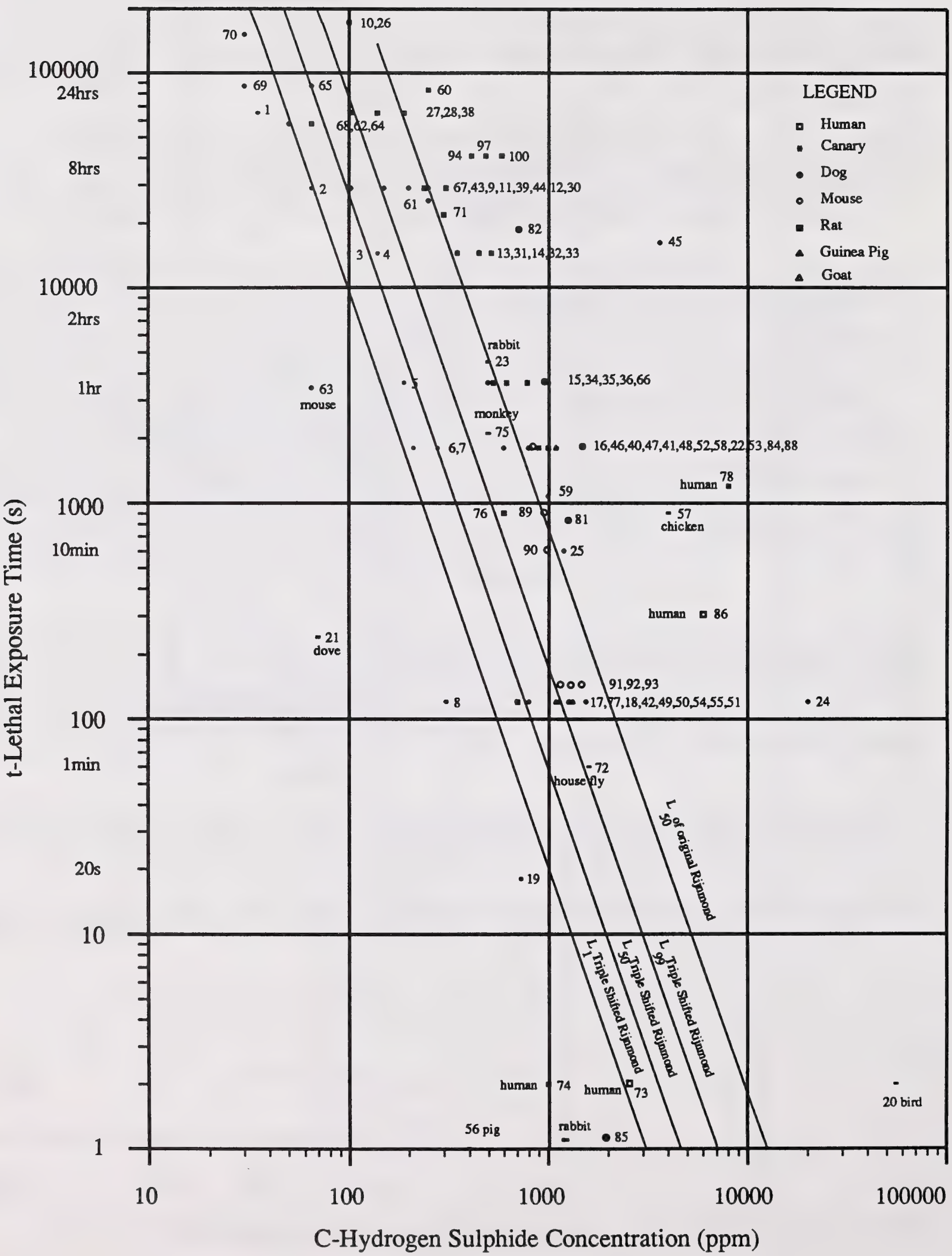

FIGURE B-3

TOXIC LOAD-HYDROGEN SULPHIDE

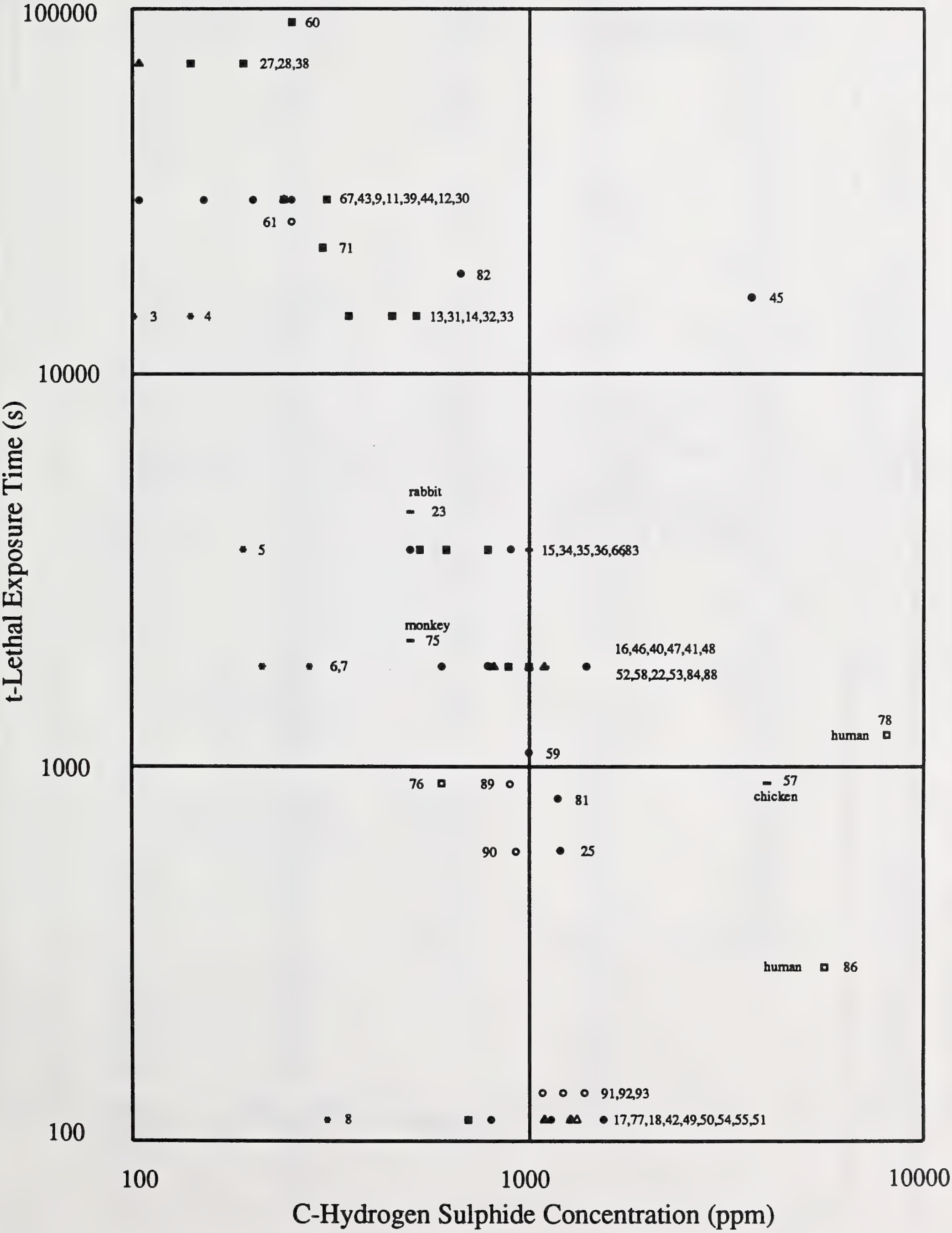

Table B-1

Lethality Data

Point #	Source	Species	Conc (ppm)	t_o	# of humans or animals
1	Mitchell & Yant (1925)	Canary	35	18 hr	2
2	"	"	65	8 hr	2
3	"	"	100	4 hr	6
4	"	"	139	4 hr	4
5	"	"	189	1 hr	4
6	"	"	211	30 min	3
7	"	"	278	30 min	?
8	"	"	307	2 min	?
9	"	Dog	100	48 hr	?
10	"	"	150	8 hr	?
11	"	"	200	8 hr	?
12	"	"	250	8 hr	?
13	"	"	350	4 hr	?
14	"	"	450	4 hr	?
15	"	"	500	1 hr	?
16	"	"	600	30 min	?
17	"	"	700	0 - 2 min	?
18	"	"	800	0 - 2 min	?
19	Lehman (1892)	Canary	729	18 - 20 sec	
20	Barker	Bird	55,555	0 - 2 sec	?
21	Eulenberg (1865)	Dove	70	4 min	1
22	"	Cat	1100	30 min	1
23	Biefel & Polek	Rabbit	500	75 min	1
24	Brouardel & Loye (1885)	Dog	20,000	2 - 3 min	?
25	Mitchell & Yant (1925)	"	1200	10 - 15 min	?
26	"	Rat	100	48 hr	19
27	"	"	139	18 hr	
28	"	"	189	18 hr	17
29	"	"	239	8 hr	
30	"	"	307	8 hr	13
31	"	"	350	4 hr	
32	"	"	450	4 hr	2
33	"	"	518	4 hr	3
34	"	"	529	1 hr	
35	"	"	618	1 hr	3
36	"	"	786	1 hr	40
37	"	"	896	30 min	
38	"	Guinea Pig	103	18 hr	2
39	"	"	239	8 hr	2/3
40	"	"	814	30 min	10
41	"	"	1000	30 min	2
42	"	"	1093	2 min	
43	"	Dogs	103	8 - 18 hr	2
44	Mitchell & Yant (1925)	Dogs	239	8 - 18 hr	2
45	"	"	350	4 - 8 hr	2
46	"	"	796	30 min	1/2
47	"	"	886	30 min	3
48	"	"	1000	30 min	8
49	"	"	1136	2 min	
50	"	"	1271	2 min	4
51	"	"	1493 - 1593	2 min	9
52	"	Goat	1000	30 min	4
53	"	"	1093	30 min	
54	"	"	1271	2 min	4
55	"	"	1321	2 min	

Table B-1 (Continued)

Lethality Data

56	O'Donoghue (1961)	Pig	400	1 sec	1
57	Klentz & Fedde (1976)	Chicken	4000	15 min	?
58	Weedon et al (1940)	Rat	1000	29 - 37 min	8
59	"	Mice	1000	18 - 20 min	4
60	"	Rat	250	23 hr	3/8
61	"	Mouse	250	7 hr	4/4
62	"	Rat	65	16 hr	1/8
63	"	Mouse	65	57 min	1/4
64	"	"	65	16 hr	3/4
65	"	"	65	24 hr	1/4
66	"	House Fly	1000	1 hr	87/100
67	Hays (1972)	Mouse	100	8 hr	3/8
68	"	"	50	16 hr	
69	"	"	30	24 hr	3/8
70	"	"	30	42 hr	2/8
71	Alta. Envt. Centre (1986)	Rat	300	6 hr	12/12
72	Evans	House Fly	1600	1 - 2 min	90/100
73	Prouza (1970)	Humans	1000	< 1 min	1/10
74	Niosh (1977)	"	1000	2 sec	1/1
75	Milby (1962)	Monkey	500	35 min	1/3
76	"	Man	600	15 min	
77	"	"	700	2 min	
78	McCabe & Clayton (1952)	"	~8000	20 min	22/320
79	Mitchell & Yant (1925)	"	50 - 100	8 - 48 hr	0/1
	"	"	100 - 150	8 - 48 hr	?
	"	"	150 - 200	8 - 48 hr	?
	"	"	250 - 350	4 - 8 hr	?
	"	"	350 - 450	4 - 8 hr	?
	"	"	500 - 600	15 - 60 min	?
	"	"	700	0 - 2 min	?
	"	"	700 - 785	0 - 2 min	?
	"	Dogs	1200	10 min	?
80	Sandage (1961)	Rat	20	90 days @ 24 hrs/day	20/100
81	Haggard (1921)	Dog	1000	15 min	?
82	Haggard (1925)	"	500 - 700	several hrs	?
83	"	"	900	< 1 hr	?
84	"	"	1500	15 - 30 min	?
85	"	"	1800	immediate	?
86	Winek et al (1968)	Human	6100	< 5 min	1/1
87	O'Donoghue (1961)	Rabbit	1000	1 sec	1/3
88	Clanechan (1979)	Mouse	800	30 min	1/20
89	"	"	900	15 min	2/20
90	"	"	1000	10 min	3/46
91	"	"	1100	2.5 min	1/20
92	"	"	1200	2.5 min	2/40
93	"	"	1300	2.5 min	3/20
94	Tansy et al (1981)	Rat	400		3/10
95	"	"	440		/10
96	"	"	475		/10
97	"	"	500		8/10
98	"	"	525		8/10
99	"	"	554		9/10
100	"	"	600		10/10

Table B-2

Reports of Lethality for H_2S

Reference	Details
20 Barker	1 part H_2S/18 parts air---kills birds immediately (55,000 ppm) 1 part H_2S/210 parts air---asphyxiated dogs (4761 ppm) (no time given)
21 & 22 Eulenberg (1865) (see Mitchell, 1924 for reference)	1000 ppm---fatal for cats, rabbits & doves "within a short time" dove killed in 4 min @ 0.007% (70 ppm) 140 ppm for 10 min---no effect on cat but; 70 ppm for 25 min---asphyxia (slower death) 1100 ppm for 30 min---death (more immediate)
23 Biefel & Polek (1880)	500 ppm for 75 min---death of rabbit
24 Brouardel & Loye (1885)	dogs---20,000 ppm---death 2 - 3 min
67 to 70 Hays (1972)	mice (3/8 female mice) died for each of 100 ppm amd 30 ppm/8 hr exposure. Modified lethal concentration duration 50 = 7.5 hr
72 Evans	house flies (90% killed) after 1 - 2 min. exposure/1600 ppm
78 McCabe	Poza Rica, Mexico 160,000 ppm H_2S 22 deaths/320 hospitalized exposure duration ~ 20 minutes (not known if instantaneous, intermediate or continuous) 22 deaths............9 dead on arrival ....4 dead within 2 hours ....4 dead within 6 hours ....1 @ 24 hours ....1 @ 48 hours ....1 @ 5 days ....1 @ 6 days ....1 @ 9 days H_2S ~ 31,000 ppm
79 Mitchell & Yant (1925)	A. Man 50 - 100 ppm 8 - 48 hr--no effect 100 - 150 ppm 8 - 48 hr--death 150 - 200 ppm 8 - 48 hr--death 250 - 350 ppm 4 - 8 hr--death 350 - 450 ppm 4 - 8 hr--death 500 - 600 ppm 15 - 60 min--death 700 ppm 0 - 2 min--death 700 - 785 ppm 0 - 2 min--death B. Dogs: 1200 ppm for 10 min--death (10 - 15 min)
94 - 100 Tansy et al (1981)	Sprague-Dawley rats (male & female) LC_{50} = 444 ppm (4 hr)
Kleinfeld (1964)	89 people exposed to H_2S; 12 people severe - 2/12 died First man - ~ 30 min exposure; conc. unknown Second man - same

Appendix C

Toxic Load and Fatality Estimates For Fluctuating Concentrations of Sour Gas

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December 1987

ERCB Technical Paper

1 INTRODUCTION

Hazard assessments track a toxic gas release as it is carried downwind from its source to a biological receptor. During its travel, the plume is diluted by air entrainment caused by self-generated turbulence in the release jet and by atmospheric turbulence. Estimating this dilution is a formidable task which must include a wide range of release and weather conditions. Most hazard assessments are carried out by engineers and meteorologists, and focus most of their efforts on making accurate estimates of this downwind dilution process.

However, the most important aspect of the problem is how the toxic gas cloud will affect people, animals and vegetation. Our state of knowledge in making quantitative estimates for biological response to toxic gases is often much less certain than our knowledge of the atmospheric dispersion and dilution process. It is only in the last 10 years that quantitative estimates for adverse effects on biological receptors have been incorporated in hazard assessments. Nussey and Pape (1987) describe the hazard model used by the Health and Safety Executive in the U.K and present a comprehensive sensitivity study of release, dispersion and biological response for chlorine and ammonia releases from chemical plants. The largest variations in their predicted fatalities were caused by two factors: uncertainty in release conditions and their estimates for biological response. In a previous study Nussey, Mercer and Fitzpatrick (1985) focus on the toxicity model (for chlorine) and show that there is considerable uncertainty in estimating fatalities. Their work highlights the need for better estimates of toxic response, even for well documented gases such as chlorine and ammonia.

This report will focus on problems associated with the random turbulent variability of a fluctuating concentration to which a receptor is exposed, combined with the natural variability in biological response of a population. The objective of the analysis presented here will be to estimate the number of people adversely affected during a toxic gas release. The questions which must be dealt with to estimate this biological response are:

- How much concentration fluctuation is likely to occur during the exposure?
- What is the effective toxic load imposed on a biological receptor by this fluctuating concentration?
- How will a population of varying susceptibility respond to this toxic load?

To answer these questions we will use statistical methods to characterize both the variability of the concentration fluctuations, and the degree of susceptibility of a population of biological receptors such as people, animals, or vegetation.

Quantitative Estimates of Biological Response

Most dispersion models used for hazard assessment and for the regulatory control of air pollution give as their outputs a mean concentration over some specified averaging time. The expected damage from this predicted exposure is found by comparing these values to threshold exposure values at which damage has been observed in biological systems. If the predicted concentration is greater than the threshold value, the population is assumed to be in danger of being injured.

There are some major difficulties with applying the concept of a threshold concentration to injury. The first is that the degree of injury is usually unspecified, leaving us to apply common sense judgments to the relative severity of predictions which exceed the threshold by a factor of ten compared to a factor of two. The usual regulatory approach is to assume that anything over the threshold is completely unacceptable, and that anything slightly under the threshold is completely acceptable.

A second, and even more important deficiency, is that there may be considerable uncertainty in the exposure (averaging) time for which a concentration predicted by an atmospheric dispersion model applies. Dispersion predictions often list concentrations to several significant digits, and then vaguely define the averaging time as anywhere from "3 to 30 minutes".

Added to this is the vagueness with which toxicologists document the susceptibility, level of activity (e.g. resting, walking, running), and concentration-time history of the test population used to set threshold response levels. The effect of all these uncertainties to lower the credibility of predicted damage from exposure to toxic gases. To restore this credibility a more realistic and carefully documented approach is required.

The Concept of Toxic Load

In attempting to deal with the combined effect of concentration and exposure time, a linear time integrated concentration has been used successfully in predicting cumulative effects such as heavy metal poisoning and radiation. However, for many toxic gases the effects of concentration and exposure time are nonlinear, so that doubling the concentration for the same exposure time produces more than twice as great an adverse effect. The simplest nonlinear factor for an exposure time t_e is the toxic load L, defined as

$$L = \int_0^{t_e} C^n dt \tag{1}$$

where C is the instantaneous concentration which is a function of time t. If the concentration has a constant exposure level C_e, which does not vary with time, (1) becomes,

$$L = C_e^n t_e \tag{1A}$$

When $n = 1$, the toxic load L is called the dose, $C_e t_e$.

Surprisingly, the use of toxic load as a simple extension of the idea of time integrated dose is a relatively new development. Larson, Gardener and Coffin (1976, 1979) found that the toxic load concept could be applied equally well to predicting leaf injury in vegetation due to ozone exposures and increased mortality of mice for exposure to NO_2. In both cases they expressed the non linear effect as modifying the exposure time, $C_e t_e^{1/n}$, rather than concentration $C_e^n t_e$. Because the time integrated non-linear dose is a product of concentration and time, it is not possible to determine whether the exponent n should be applied to the concentration or the time and using $C_e t_e^{1/n}$ produces the same toxic response as using $C_e^n t_e$. Because the toxic load in (1) is expressed as an integral with respect to time, it is convenient to show the non linearity acting on the concentration rather than on the exposure time.

The response of animals to most toxic gases is highly non linear. Correlations of existing toxicity data by ten Berge and van Heemst (1983) and ten Berge (1985, 1986) show that the exponent in (1A) lies in the range from n = 2.0 to 3.0 for a wide variety of toxic gases including H_2S.

Although the use of toxic load is a considerable improvement over threshold level and linear dose estimates, there are still some deficiencies. Toxicity data for adverse effects on animals is only available over a limited range of exposure times. While a constant value of the exponent n may apply over a fairly wide range of exposure times, it is unlikely that the same value of n will be valid for both very short or very long exposures. A change in n with increasing exposure time may reflect a change in the mechanism by which a toxic effect is produced, the part of the organism on which it acts, or the rate of uptake. In particular, it does not seem plausible that a very large concentration of a highly toxic gas such as hydrogen sulphide would be tolerable even for very short exposure times. Considerable care must be taken to apply the toxic load equations only within the exposure time limits for which they were derived from biological data.

Toxic load does not account for the rate of uptake of a toxic gas by a biological receptor, nor does it provide for any detoxification mechanism through metabolic processes. The basic assumption in the definition for toxic load in (1) is that biological systems have a very rapid time response to concentration and are capable of responding to short duration concentration fluctuations. In reality, biological receptors can be modelled as having a response time constant which attenuates high frequency fluctuations. This response time constant should depend on the type of toxic gas and metabolic rate, which in turn depends on the level of activity. Wilson and Simms (1985) present simple methods for correcting the concentration fluctuation variance for this response time constant. Unfortunately, to apply these methods, both the concentration fluctuation frequency spectrum and the response time constant of the biological system must be known. These are two pieces of information that are, to put it mildly, difficult to specify accurately.

Because toxic load does not account for detoxification, the toxic loads received in two different time exposure will simply add. While this cumulative dose may be reasonable for estimating radiation and heavy metal poisoning, it is not appropriate for many toxic gases. By ignoring detoxification we are assuming implicitly that the exposure time is much shorter than detoxification time of the biological system. For exposures to hydrogen sulphide in accidental releases of sour gas this may be a reasonable assumption, because exposure times are generally confined to periods of a few minutes to a few hours.

The Probit Method For Variability Of Biological Response

In any population of people, animals or vegetation, there are varying degrees of susceptibility to adverse effects from toxic gas exposure. The first accurate estimates of the type of statistical distribution which describes population susceptibility was found by investigators studying the effects of insecticides. The probability of lethality response was found to be log-normal, so that the fraction of population affected was a function of the logarithm of concentration-time dose.

The PROBIT method described by Bliss (1934) was developed to provide a simple logarithmic transformation which would allow the cumulative response of a log-normal probability distribution to be represented as a straight line on a graph. Finney (1947) produced a comprehensive monograph on the PROBIT methods. Although his book focuses on insecticide effectiveness, it shows other data to support the use of a log-normal response to toxic exposure for many biological systems. Much of the appeal of PROBIT methods to toxicologists is the simple straight line transformation which allows an investigator to see at a glance how closely the observed response follows a log-normal cumulative distribution.

Combining Toxic Load and PROBIT Methods

The use of toxic load as the appropriate non-linear variable to describe the log-normal response of a population is a recent development. One early application to pollution exposure appears to be the work of Larson, Gardener and Coffin (1976, 1979) and was aimed at setting pollution control regulations. The combination of toxic load and PROBIT in hazard assessment was proposed by Lees (1980, 1987) and his co-workers, Poblete and Lees (1984), Lees, Poblete and Simpson (1986), Petts, Withers and Lees (1987).

One of the earliest systematic applications of the combined toxic load and log-normal population response to hazard assessment was for six facilities located at the port of Rijnmond in the Netherlands, see COVO (1982). Their correlations of toxicity data, and later work by ten Berge (1985, 1986) demonstrated that biological response to several gases including H_2S could be quantitatively described by the toxic load/PROBIT method.

The weakest link in most hazard assessments using toxic load methods is the estimate of biological response to a particular toxic gas. A major source of uncertainty lies with the vague and anecdotal way in which toxicity data is reported. Even when this data is abundant, as in the case of chlorine, Withers and Lees (1985a,b), (1987) show the need for careful interpretation of data to determine the effect of changing respiration rate with level of activity and in dealing with the varying susceptibility of normal and vulnerable populations. The discussion in Withers and Lees (1987) of the problems that occur when people attempt to walk out of a toxic cloud, and are overcome because of their increased level of activity and respiration is of particular interest. Their studies provide a good example of the methods that should be used to develop similar toxicity estimates for exposure to hydrogen sulphide and sulphur dioxide in sour gas releases.

Concentration Fluctuations During Exposure

The analysis in this report develops methods for dealing with concentration fluctuations which are the natural result of inhomogeneous mixing during atmospheric dispersion. Because this inhomogeneous mixing is caused by atmospheric turbulence and plume meandering due to wind direction changes, we must apply statistical methods to describe the intensity and frequency of concentration fluctuations. A semi-empirical model for the variation of these fluctuations through a plume from a ground level source has been developed by Wilson, Robins and Fackrell (1982), and for an elevated release by Wilson, Fackrell and Robins (1982). Both these theories are based on wind tunnel data. The effect of plume meandering on fluctuations is dealt with by Wilson and Simms (1985).

Both large scale plume meandering and small scale inhomogeneous mixing will produce intermittent periods of zero concentration. To describe the fluctuation statistics in an intermittent exposure of this kind, we must first divide the exposure into the fraction of time (1-γ) where the concentration is zero and the fraction γ when concentrations larger than zero are observed. The conditional mean and variance $\overline{C}_p$ and $\overline{C'^2_p}$ with zero periods removed can then be used in a probability distribution to compute mean and fluctuating components of toxic load. The relation between the total mean $\overline{C}$ and variance $\overline{C'^2}$ (with zero periods included) and the conditional values with zeros removed is discussed in Wilson, Robins and Fackrell (1985).

There are several choices for an appropriate probability density function to describe the variability of the non zero concentrations. Wilson and Simms (1985) show that either a log-normal or gamma probability distribution give reasonable estimates of fluctuating concentrations. Recent data from laboratory simulation of plumes, Wilson and Zelt (1988), show that both the log normal and gamma distributions tend to overestimate the probability of observing concentrations larger than about four times the conditional mean. Because toxic load depends on concentration raised to a power somewhere between squared and cubed the high concentration peaks that will contribute most to the toxic load, and estimates made using a log normal or gamma distribution will tend to overestimate somewhat the magnitude of the mean and peak toxic loads. However, there does not appear to be a simple probability distribution with fixed coefficients that is capable of covering the entire range of fluctuating concentrations.

For computational convenience, we will use a log-normal distribution for estimates of toxic load. The choice of a log-normal distribution is convenient because, if the concentration fluctuations are distributed log normally, our analysis will show that fluctuations in toxic load will also follow a log normal distribution. Because the variability of a biological population also follows a log normal distribution, we will be able to use the same functional forms for the cumulative distributions of concentration fluctuations, toxic load and biological response. To avoid confusion, the reader must keep firmly in mind that the median and standard deviation used to define these three log normal distributions are different, and in the case of biological response, are based on entirely different physical processes.

The effect of concentration fluctuations on the non linear time integrated toxic load has been addressed by other investigators. Griffiths and Megson (1984) and Griffiths and Harper (1985) developed a simple model in which all fluctuations are caused by the plume intermittency which pulls the concentration down from a constant conditional value to zero. Ride (1984) produced the same results using a simple physical model based on spherical eddies of constant concentration separated by regions of uncontaminated air. All these investigations showed the extreme sensitivity of the toxic load to plume intermittency. In the following analysis we will extend this approach to deal with plumes which have internal concentration fluctuations during their non-zero periods.

2 TOXIC LOAD FOR FLUCTUATING CONCENTRATION WITH LOG-NORMAL PROBABILITY DENSITY.

The toxic load L for an exposure time t_e is defined by (1). The probability (i.e. fraction of time) of observing a given concentration is determined by the probability density function (pdf), which is defined only for the periods when the concentration is non-zero. To make use of the pdf, we must distinguish between periods of zero and non-zero concentration by defining the conditional concentration C_P and the fraction of time, γ that the concentration is non-zero.

The intermittency factor γ is the ensemble average of the instantaneous intermittency function γ_i which has the values $\gamma_i \equiv 0$ when $C = 0$ and $\gamma_i \equiv 1.0$ when $C > 0$. In effect, the fluctuating instantaneous intermittency function γ_i is a square wave which takes on the values of zero and unity to mark periods of non-zero concentration. We can then write the n[th] moment of concentration as

$$\int_0^{t_e} C^n dt = \int_0^{t_e} (1-\gamma_i)0^n dt + \int_0^{t_e} \gamma_i C_P dt \tag{2}$$

The first integral obviously is zero, so that an ensemble average of the equation becomes

$$\int_0^{t_e} \overline{C^n} dt = \int_0^{t_e} \overline{\gamma_i C_p^n} dt \tag{3}$$

Here we have used the characteristic that the ensemble average of an integral is the same as the integral of the average, and that $\overline{AB} = \overline{A} \cdot \overline{B}$ for any two uncorrelated variables A and B. Noting that $\gamma = \overline{\gamma_i}$ by definition, we obtain

$$\int_0^{t_e} \overline{C^n}(t) dt = \int_0^{t_e} \gamma(t) \overline{C_p^n} dt \tag{4}$$

In a situation where the toxic gas release rate varies with time, it is essential to interpret the overbar as an ensemble average of many identical releases, rather than a time average. If we limit ourselves to steady, continuous plumes, where the ensemble averages are steady, γ, $\overline{C^n}$, $\overline{C_p^n}$ are no longer functions of time and (4) reduces to

$$\overline{C^n} = \gamma \overline{C_P^n} \tag{5}$$

It is interesting to note that (5) can be used to define an exact relation between intermittency and the total and conditional fluctuation intensities by taking n=1 to get the mean, and n=2 to get the mean square, to write

$$\overline{C} = \gamma \overline{C_p} \tag{6}$$

and

$$\overline{C^2} = \gamma \overline{C_p^2} \tag{7}$$

Expanding, using mean and fluctuating components, (7) becomes

$$\overline{(\overline{C} + C')^2} = \gamma \overline{(\overline{C}_p + C'_p)^2} \tag{8}$$

or

$$\overline{C}^2 + \overline{C'^2} = \gamma\left(\overline{C}_p^2 + \overline{C'^2_p}\right) \tag{9}$$

Divide (9) by $\overline{C}^2 = \gamma^2 \overline{C}_p^2$ from (6) to obtain

$$1 + \frac{\overline{C'^2}}{\overline{C}^2} = \gamma\left(\frac{\overline{C}_p^2}{\gamma^2 \overline{C}_p^2} + \frac{\overline{C'^2_p}}{\gamma^2 \overline{C}_p^2}\right) \tag{10}$$

which reduces to

$$\gamma = \frac{1 + i_p^2}{1 + i^2} \tag{11}$$

where $i^2 = \overline{C'^2} / \overline{C}^2$ and $i_p^2 = \overline{C'^2_p} / \overline{C_p}^2$ are total and conditional intensities for a sampling time $T_S = T_e$. Returning to the problem of defining the mean toxic load for an unsteady plume from a transient release, where the ensemble averages may be functions of time, we see by comparing (1) and (3) that the mean toxic load $\overline{L}$ is

$$\overline{L}(t) = \int_0^{t_e} \gamma(t) \overline{C_p^n}(t) dt \tag{12}$$

Note that for an unsteady release, the intermittence γ must remain within the time integral. If we limit our attention to a steady plume, then γ and $\overline{C_p^n}$ are constant with time, and (12) reduces to

$$\overline{L} = \gamma \overline{C_p^n} t_e \tag{13}$$

This can be written in terms of the pdf (probability density function) of C_p using

$$\overline{C_p^n} \equiv \int_{C_p=0}^{\infty} C_p^n p(C_p) dC_p \tag{14}$$

where $p(C_p)$ is the probability of finding C_p in the range from C_p to $C_p + dC_p$. If we assume C_p is distributed log-normally, it is shown in Appendix A that

$$\overline{C_p^n} = \overline{C}_p^n (1 + i_p^2)^{\frac{n(n-1)}{2}} \tag{15}$$

where i_p is the conditional fluctuation intensity for a sampling time t_s equal to the exposure time $t_s = t_e$.

Combining (12), (13) and (15)

$$\overline{L} = \gamma (1 + i_p^2)^{\frac{n(n-1)}{2}} \overline{C_p}^n t_e \tag{16}$$

for $\overline{C_P}$ = constant

2.1 Using Total Mean $\overline{C}$ In Toxic Load Definitions

All our dispersion models predict the total mean $\overline{C}$, including the zero concentration periods, rather than the conditional mean $\overline{C_p}$ with the zeros removed. These two means are related by the intermittency γ in (6). Using (6) in (16) the mean toxic load for a steady plume becomes

$$\overline{L} = \gamma (1 + i_p^2)^{\frac{n(n-1)}{2}} \left(\frac{\overline{C}}{\gamma} \right)^n t_e$$

$$= \frac{(1 + i_P^2)^{\frac{n(n-1)}{2}}}{\gamma^{n-1}} \overline{C}^n t_e \tag{17}$$

which reduces to

$$\overline{L} = \left(\frac{(1 + i_{PT}^2)^{\frac{n}{2}}}{\gamma} \right)^{n-1} \overline{C}^n T_e \tag{18}$$

for $\overline{C}$ = constant in time

2.2 Fluctuations In Toxic Load

Because of natural variability, in the form of concentration fluctuations, there will be a variability in the toxic load, L, calculated for each realization. In (16), we showed that because L is a higher order moment, its ensemble mean $\overline{L}$ is also affected by the fluctuation intensity i_p.

The variability in toxic load L between individual realizations will be the same as the variability in C_p^n, with fluctuations smoothed by averaging over time periods of duration equal to the exposure time t_e.

The pdf of L values will be the same as the pdf of C_p^n. Recall from Appendix A, for a log-normal pdf for C_p in (A1) and (A3)

$$p(C_p) = k \exp\left(\frac{-(\ln C_p - \ln C_{pM})^2}{2S^2}\right) \tag{19}$$

where k is a constant, C_{pM} is the mode and S is the log-standard deviation which is defined in equation (A18) in terms of i_p

$$S^2 = \ln(1 + i_{pa}^2) \tag{20}$$

where i_{pa} is smoothed over an averaging time equal to the exposure time, $t_a = t_e$. The pdf of C_p^n can be derived from (19) by defining

$$\varnothing \equiv C_p^n \tag{21}$$

so that (19) becomes

$$p(\varnothing) = k_\varnothing k \exp\left(\frac{-\left(\ln\left(\varnothing^{\frac{1}{n}}\right) - \ln\left(\varnothing_M^{\frac{1}{n}}\right)\right)^2}{2S^2}\right) \tag{22}$$

which reduces to

$$p(\varnothing) = k_\varnothing k \exp\left(\frac{-(\ln \varnothing - \ln \varnothing_M)^2}{2n^2S^2}\right) \tag{23}$$

where $k_\varnothing$ is the constant necessary to produce a unity integral

$$\int_0^\infty p(\varnothing)d\varnothing = 1.0 \tag{24}$$

The pdf of $\varnothing = C_p^n$ in (23) is also a log-normal distribution with the same mode $\varnothing_M = C_{pM}^n$ as the pdf of the conditional concentration C_p and a larger log-standard deviation given by:

$$S_{\varnothing} = nS \tag{25}$$

where S is the log standard deviation of C_p and $S_{\varnothing}$ is the log standard deviation for C_p^n.

Next, define a toxic load fluctuation intensity i_L in terms of i_p by first noting that

$$\overline{\varnothing^2} = \overline{\varnothing}^2 + \overline{\varnothing'^2} \tag{26}$$

or,

$$\frac{\overline{\varnothing^2}}{\overline{\varnothing}^2} = 1 + i_{\varnothing}^2 \tag{27}$$

where

$$i_{\varnothing} \equiv \frac{\sqrt{\overline{\varnothing'^2}}}{\overline{\varnothing}} \tag{28}$$

By direct analogy with equation (A6), we can express the "ath" moment of L for its log-normal pdf in (23) as

$$\overline{\varnothing^a} = \exp\left(a \ln \varnothing_M + \frac{a^2}{2} S_{\varnothing}^2\right) \tag{29}$$

The first and second moments with a=1, 2 are

$$\overline{\varnothing} = \exp\left(\ln \varnothing_M + \frac{1}{2} S_{\varnothing}^2\right) \tag{30}$$

and

$$\overline{\varnothing^2} = \exp(2 \ln \varnothing_M + 2 S_{\varnothing}^2) \tag{31}$$

Using these in (26) gives a result analogous to (A12)

$$\exp(S_{\varnothing}^2) = 1 + i_{\varnothing}^2 \tag{32}$$

Then using $S_{\varnothing} = nS$ from (25), it is easy to show that (32) can be written as

$$(\exp(S^2))^{n^2} = 1 + i_{\varnothing}^2 \tag{33}$$

Using (A12) in (A20), this simplifies to

$$(1+i_{pa}^2)^{n^2} = 1 + i_\varnothing^2 \tag{34}$$

where i_{pa} is smoothed over successive averaging time periods equal in length to the exposure time. Then, use the observation that toxic load L is proportional to C_p^n, so the pdf of L and its fluctuation intensity i_L must be identical to the pdf and intensity of $\underline{\varnothing \equiv C_p^n}$. Replace $i_\varnothing$ in (34) with i_L to get

$$i_L^2 + 1 = (i_{pa}^2 + 1)^{n^2} \tag{35}$$

Note that i_{pa} is different than the intensity i_{pT} for the sampling time t_s. The intensity i_{pa} is always less than i_p because i_{pa} is smoothed over an averaging time equal to the exposure time t_e.

The pdf of the toxic load, like the pdf of $\varnothing$ is also log-normal. In our transformed notation with $r \equiv \ln(L)$ the median load L_M from $r_M \equiv \ln(L_M)$. Appendix A gives

$$p_r(\ln(L)) = \frac{1}{\sqrt{2\pi}S_L}\exp\left(\frac{-(\ln L - \ln L_M)^2}{2S_L^2}\right) \tag{36}$$

which is not the most useful form because it is defined in terms of (ln L) so that

$$\int_{-\infty}^{\infty} p_r(\ln L)d(\ln L) = 1.0 \tag{37}$$

Instead, converting to L rather than (ln L) by using $d(\ln L) = 1/L\, dL$

$$p(L) = \frac{1}{\sqrt{2\pi}LS_L}\exp\left(\frac{-\left(\ln\left(\frac{L}{L_M}\right)\right)^2}{2S_L^2}\right) \tag{38}$$

From (25) we have $S_L = nS$ and using (20), this can be written as

$$S_L = n(\ln(1+i_{pa}^2))^{0.5} \tag{39}$$

The median toxic load L_M is related to the mean toxic load $\overline{L}$ by

$$L_M = \overline{L}\exp\left(\frac{-S_L^2}{2}\right) \tag{40}$$

as shown in Appendix A. Note that (38) is defined so that

$$\int_0^{\infty} p(L)dL \equiv 1.0 \tag{41}$$

A useful form for the pdf of L is the cumulative distribution $\Omega(L)$

$$\Omega(L) \equiv \int_0^L p(L)dL \tag{42}$$

From Appendix A, equation (A10) for this cumulative distribution for an intermittent log-normal may be written for toxic load L as

$$\Omega(L) = (1-\gamma_L) + \frac{\gamma_L}{2}\left[1 + erf\left(\frac{\ln\left(\frac{L}{L_M}\right)}{\sqrt{2}S_L}\right)\right] \tag{43}$$

The value of γ_L is the fraction of toxic loads that will be non-zero. The value of γ_L will be the same as the concentration intermittency γ_a, evaluated for averaging time t_a equal to the exposure time t_e. In most cases the exposure time will be long enough that some non-zero values of C will be observed, in which case $\gamma_L = 1.0$.

For most practical situations where the receptor is located on the centreline of a plume, it is reasonable to assume that $\gamma_L = 1.0$, so that (43) reduces to

$$\Omega(L) = \frac{1}{2}\left[1 + erf\left(\frac{\ln\left(\frac{L}{L_M}\right)}{\sqrt{2}S_L}\right)\right] \tag{44}$$

for $\gamma_L \equiv 1.0$

3 FRACTION OF A BIOLOGICAL POPULATION WITH ADVERSE EFFECTS

This estimate requires two different functions of toxic load:

- The distribution of the fraction of people suffering a specified adverse effect (e.g. death) as a function of toxic load.

- The probability distribution of occurrence toxic loads as a function of mean concentration - time exposure, fluctuation intensity and intermittency.

By combining these two distributions, we can compute the average fraction $\overline{p_a}$, of the population that will have the injury, as well as the variability of this fraction in terms of its variance $\overline{p_a^{12}}$.

It is common practice to express the fraction of a population with an adverse effect by means of a PROBIT analysis. The PROBIT (probability unit) is the variable Y, defined in Poblete and Lees (1984).

$$Y = k_1 + k_2 \ln(L) \tag{45}$$

where L is the toxic load

$$L = \int_0^{Te} C^n dt \tag{46}$$

The probability P that a given toxic load will cause an adverse effect is

$$P = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{Y-5} \exp\left(\frac{-u^2}{2}\right) du \tag{47}$$

This is a very cumbersome method because it puts the variable of interest "L" as the limit of an integral, rather than an explicit function.

The probit transformation is simply a log-normal pdf of probability of the adverse effect. It is much more useful to write the probability density $p_a(L)$ of the adverse affect directly, as the log-normal distribution.

$$p_a(L) = \frac{1}{\sqrt{2\pi} S_a L} \exp\left(\frac{-\left(\ln\left(\frac{L}{L_{50}}\right)\right)^2}{2} S_a^2\right) \tag{48}$$

where

L_{50} = the toxic load required to produce the specified adverse effect in 50% of the population. In statistical terms, this is the median load.

S_a = log standard deviation of the adverse effect distribution expressed in toxic load units.

The cumulative probability of experiencing the adverse effect is simply

$$P(L) = \int_0^{L} p_a(L) dL \tag{49}$$

For the log normal pdf in (4), this integral is,

$$P(L) = \frac{1}{2}\left[1 + erf\left(\frac{\ln\left(\frac{L}{L_{50}}\right)}{\sqrt{2}S_a}\right)\right] \tag{50}$$

Poblete and Lees (1984) give the relation between the widely published constants k_1 and k_2 in the probit equation (45) and the log normal parameters L_{50} and S_a as

$$k_1 = 5 - \frac{\ln(L_{50})}{S_a} \tag{51}$$

and

$$k_2 = \frac{1}{S_a} \tag{52}$$

Toxic Load Fluctuations

Because the toxic load fluctuations are also assumed to be log normally distributed, there is great potential for confusion. The pdf of fluctuating toxic load caused by atmospheric turbulence is derived in the preceding section as

$$p(L) = \frac{1}{\sqrt{2\pi}LS_L}\exp\left(\frac{-\left(\ln\left(\frac{L}{L_M}\right)\right)^2}{2S_L^2}\right) \tag{38}$$

$$S_L = n(\ln(1 + i_{pa}^2))^{0.5} \tag{39}$$

$$L_M = \overline{L}\exp\left(\frac{-S_L^2}{2}\right) \tag{40}$$

where

L_M = median toxic load
S_L = fluctuating toxic load standard deviation (log-standard)
$\overline{L}$ = mean toxic load
$i_{pa} = \sqrt{\overline{C_p'^2}}/\overline{C_p}$ fluctuation intensity for averaging time equal to exposure time, with zero periods removed.

Equations (9) and (4) are almost identical. Both are log-normal pdf's involving toxic load L, but their physical origin is entirely different. The injury pdf p_a in (4) arises from the way in which the susceptibility to injury varies in biological populations. The toxic load pdf, p, in (9) is from the variability in toxic load fluctuations caused by turbulence in atmospheric dispersion.

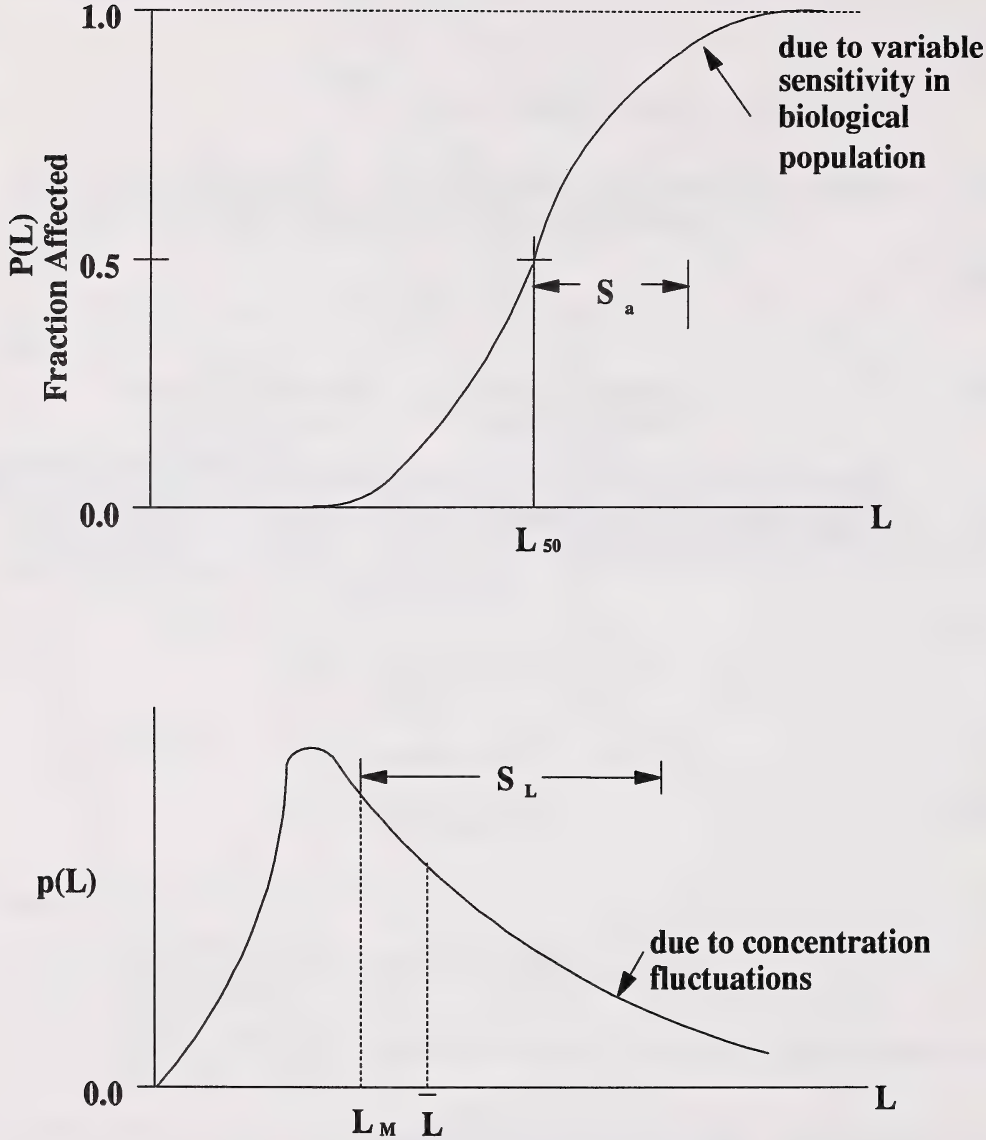
To determine the mean fraction of the population that will experience adverse effects from a fluctuating toxic load, compute the joint probability, $\overline{P}$

$$\overline{P} = \int_{L=0}^{L=\infty} P(L) \cdot p(L) dL \tag{53}$$

Combining the two pdf's from (38) and (50),

$$\overline{P} = \int_{L=0}^{\infty} \underbrace{\frac{1}{2}\left[1 + erf\left(\frac{\ln\left(\frac{L}{L_{50}}\right)}{\sqrt{2}S_a}\right)\right]}_{\substack{P(L) \\ \text{fraction of population} \\ \text{adversely affected by} \\ \text{toxic load } L}} \underbrace{\frac{1}{\sqrt{2\pi} L S_L} \exp\left(\frac{-\left(\ln\left(\frac{L}{L_M}\right)\right)^2}{2S_L^2}\right) dL}_{\substack{p_L\, dL \\ \text{probability of finding} \\ \text{load } L \text{ in the range} \\ L \text{ to } L + dL}} \tag{54}$$

Figure 1 shows that median L_{50} and log standard deviation S_a characterize the response of the biological population, while L_M and S_a characterize the variability of the toxic load due to concentration fluctuations.



Response of a Biological Population and the Variability of the Toxic Load Due to Concentration Fluctuations

Figure C.1

APPENDIX C-A

TOXIC LOAD AND NON-INTEGER MOMENTS FOR LOG-NORMAL CONCENTRATION FLUCTUATIONS

The general form for the probability density function (pdf) of a normal distribution for a variable r is

$$p_r(r) = k \exp\left(\frac{-(r - r_m)^2}{2S^2}\right) \tag{A1}$$

where k is the constant required to make the total probability equal to unity. That is, $k(r)$ is defined such that

$$\int_{-\infty}^{\infty} p_r(r)dr \equiv 1.0$$

and

S = standard deviation
r_M= median, at which cumulative probability is 0.5

for a normal distribution, the constant k is given by

$$k = \frac{1}{\sqrt{2\pi} S} \tag{A2}$$

If the conditional concentration C_P is log-normally distributed, we have

$$r \equiv \ln(C_P) \tag{A3}$$

which is the same as

$$C_P \equiv \exp(r) \tag{A4}$$

It is common to express the pdf in terms of the differential dC_P rather than dr. For equal probabilities, the pdf's of r and C_P are related at a given C_P value by

$$p_r(r)dr = p(C_P)dC_P$$

Using (A3) we have $dr = d(\ln C_P) = 1/C_P dC_P$

$$\frac{1}{C_P} p_r(r) = p(C_P)$$

and using (A2) and (A3) in (A1) we find the expected form for the log-normal

$$p(C_P) = \frac{1}{\sqrt{2\pi} C_P S} \exp\left(\frac{-\left(\ln\left(\frac{C_P}{C_{PM}}\right)\right)^2}{2S^2} \right) \tag{A5}$$

which is now defined so that using (A4)

$$\int_{-\infty}^{\infty} p(C_P) dC_P = 1.0$$

Csanady (1973) pp. 228-30 gives the relation between the median C_{PM} and the mean $\overline{C_P}$ for a log normal as

$$C_{PM} = \overline{C_P} \exp\left(\frac{-S^2}{2} \right) \tag{A6}$$

As a point of interest, it can be shown that the location of the most probable concentration, which is the "mode" of the distribution, is

$$C_{P,mode} = \overline{C_P} \exp\left(\frac{-3S^2}{2} \right) \tag{A7}$$

which is not the same as the mean or median. The cumulative distribution $\Omega_P(C_P)$ is the probability of finding a concentration less than C_P

$$\Omega_P(C_P) \equiv \int_0^{C_P} p(C_P) dC_P \tag{A8}$$

for all the non-zero concentrations and for a log-normal distribution is, using the error function, "*erf*"

$$\Omega_P(C_P) = \frac{1}{2}\left[1 + erf\left(\frac{\ln\left(\frac{C_P}{C_{PM}}\right)}{\sqrt{2} S} \right) \right] \tag{A9}$$

The total cumulative probability for non-zero concentrations that are present only a fraction γ of the total, and a fraction $(1-\gamma)$ of zero values, is

$$\Omega(C) = (1-\gamma) + \frac{\gamma}{2}\left[1 + erf\left(\frac{\ln\left(\frac{C_P}{C_{PM}}\right)}{\sqrt{2}S}\right)\right] \tag{A10}$$

where

C_{PM} = the median conditional concentration

and

S = the log-standard deviation

The general n^{th} moment of the concentration is,

$$\overline{C_P^n} = \int_{-\infty}^{\infty} C_P^n P_r(r)dr$$

Using (A4) and (A1)

$$\overline{C_P^n} = k\int_{-\infty}^{\infty} \exp(nr)\exp\left(\frac{-(r-r_m)^2}{2S^2}\right)dr$$

Expanding this yields

$$\overline{C_P^n} = k\int_{-\infty}^{\infty} \exp\left(\frac{2nrS^2 - r^2 + 2rr_M - r_M^2}{2S^2}\right)dr$$

Then, factoring and completing the square

$$\overline{C_P^n} = k\exp\left(nr_M + \frac{n^2S^2}{2}\right)\int_{-\infty}^{\infty} \exp\left(\frac{(r-(r_m+nS^2))^2}{2S^2}\right)dr \tag{A11}$$

But, this integral is exactly the same as (A1) with the median of the distribution shifted from r_M to $(r_M + nS^2)$. This translation won't affect the area under the curve, which by the definition in (A2) will still be unity, so the equation reduces to

$$\overline{C_P^n} = \exp\left(nr_M + \frac{n^2S^2}{2}\right) \tag{A12}$$

which is valid for any value of n, including non-integers.

We want to express the moments in terms of the mean and variance (ie. square of the standard deviation) instead of the log-normal distribution parameters r_M and S. To do this, use (A12) to compute the mean (first moment, n=1) and mean square (second moment n=2) using (A12)

$$\overline{C_P} = \exp\left(r_M + \frac{S^2}{2}\right) \tag{A13}$$

and

$$\overline{C_P^2} = \exp(2r_M + 2S^2) \tag{A14}$$

Then, square and ensemble average the definition $C_P \equiv \overline{C_P} + C'_P$ to yield

$$\overline{C_P^2} = \overline{C_P}^2 + \overline{C_P'^2} \tag{A15}$$

or,

$$\frac{\overline{C_P^2}}{\overline{C_P}^2} = 1 + i_P^2 \tag{A16}$$

where i_P is the concentration fluctuation intensity

$$i_P \equiv \frac{\sqrt{\overline{C_P'^2}}}{\overline{C_P}} \tag{A17}$$

Using (A13) and (A14) to compute the ratio, in (A16)

$$\frac{\exp(2r_M + 2S^2)}{\left(\exp\left(r_M + \frac{S^2}{2}\right)\right)^2} = 1 + i_P^2$$

or

$$\exp(S^2) = 1 + i_P^2$$

from which the log standard deviation S can be written as

$$S^2 = \ln(1 + i_P^2) \tag{A18}$$

Then, to express the n^{th} moment in terms of the mean $\overline{C_P}$ and i_P we use (A12) and (A13) to compute the ratio

$$\frac{\overline{C_P^n}}{\overline{C_P}^n} = \frac{\exp\left(nr_M + \frac{n^2 S^2}{2}\right)}{\left(\exp\left(r_M + \frac{S^2}{2}\right)\right)^n}$$

$$= \frac{\exp\left(nr_M + \frac{n^2 S^2}{2}\right)}{\left(\exp\left(nr_M + \frac{nS^2}{2}\right)\right)}$$

$$= \exp\left(\frac{n^2 - n}{2} S^2\right)$$

$$= (\exp(S^2))^{\frac{n(n-1)}{2}} \qquad \text{(A19)}$$

Inserting (A18) in (A19) gives, for a log-normal pdf,

$$\frac{\overline{C_P^n}}{\overline{C_P}^n} = (1 + i_P^2)^{\frac{n(n-1)}{2}} \qquad \text{(A20)}$$

It is important to note that (A20) is valid for non-integer values of n, such as those occurring in the toxic load / probit equations.

Appendix D

Defining Effective Turbulence Velocities for Dispersion in a Stable Atmosphere

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ERCB Technical Paper

Defining Effective Turbulence Velocities for Dispersion in a Stable Atmosphere

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The Gaussian plume model used by Alp et al (1987) for elevated releases, in a stable atmosphere, is strictly valid only for dispersion in homogeneous turbulence, where both σ_V and σ_W are constant with height and in the crosswind direction. (Note that an elevated release is defined as one where the final plume height z_P is larger than 2% of the Monin-Obukhov length, that is $z_{PF} > 0.02\,|L|$.)

In a stable atmosphere with a capping inversion lid at z_i, Concord Scientific, Alp et al (1987), use a vertical variation of turbulence which is

$$\sigma_W = 1.3U^*\left(1-\frac{z}{z_i}\right)^a \tag{1}$$

$$\sigma_V = 1.94U^*\left(1-\frac{z}{z_i}\right)^a \tag{2}$$

where a is an exponent that lies in the range $0 \le a \le 1.0$ with the value of a = 3/4 chosen as an average from the literature.

The problem with using (1) and (2) to define the vertical and crosswind spreads σ_z and σ_Y

$$\sigma_z = \sigma_W f_1(x) \tag{3}$$

$$\sigma_Y = \sigma_V f_2(x) \tag{4}$$

is to choose an appropriate height z_{eff} at which to evaluate the turbulence velocity.

The simplest choice for z_{eff} is to use the height of the plume centreline z_P. At first glance, this is a logical choice, because it should give the appropriate average σ_Y and σ_z for dispersion upward and downward from the plume centreline. However, for hazard assessment at ground level, we are interested only in downward dispersion from the

elevated plume centreline to ground level. For downward dispersion, the plume will experience the higher levels of turbulence that are present below the plume centreline, as shown schematically in Figure D.1.

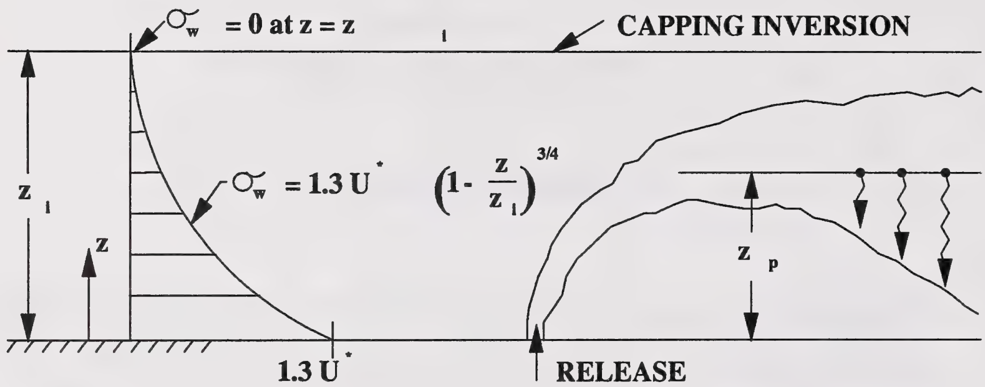

Figure D.1

Vertical Turbulence Variation in the Concord Model

There are many possibilities for choosing an appropriate weighted average of the turbulence σ_W for the lower half of the plume. The simplest is an arithmetic average between the turbulence velocity at $z = z_P$ and at $z = 0$ to obtain

$$\sigma_{W,avg} = \frac{1.3U^*}{2} + \frac{1.3U^*}{2}\left(1 - \frac{z_P}{z_i}\right)^a$$

which reduces to

$$\sigma_{W,avg} = \frac{\sigma_{W0}}{2}\left(1 + \left(1 - \frac{z_P}{z_i}\right)^a\right) \qquad (5)$$

where σ_{W0} is the vertical root mean square turbulence velocity at ground level. The problem with this approach is that it doesn't account for the larger fraction of time that the plume material spends near the plume height z_P.

Time of Flight Average

To account for the trajectory of plume elements as they diffuse downward from the plume centreline, a simple model will be developed based on the following principles and assumptions:

1. Fluid parcels (plume eddies) diffuse downward and upward from the plume centreline at an effective transport velocity that is a fixed fraction B_1 of the local RMS turbulence velocity σ_W. So, as a plume eddy passes through a location Z, its vertical velocity will be $W = B_1\sigma_W$.

2. The appropriate average effective transport velocity $W_{eff} = B_1\sigma_{Weff}$ in the vertical direction is the velocity that will produce the same travel time t_{down} for an eddy being transported between plume height z_P and ground level.

3. While the plume eddies are being transported to the ground, they also diffuse in the crosswind direction at V_{eddy}, some fraction $B_2\sigma_V$ of the local crosswind RMS velocity σ_V.

The basic principle governing the model is that it is the travel time rather than travel distance that is the variable which governs dilution as plume eddies diffuse to the ground.

By considering a plume in uniform homogeneous turbulence, that has a constant value of σ_W and U, we find that, on average, the trajectories of eddies are straight lines with a slope $B_1\sigma_W/U$.

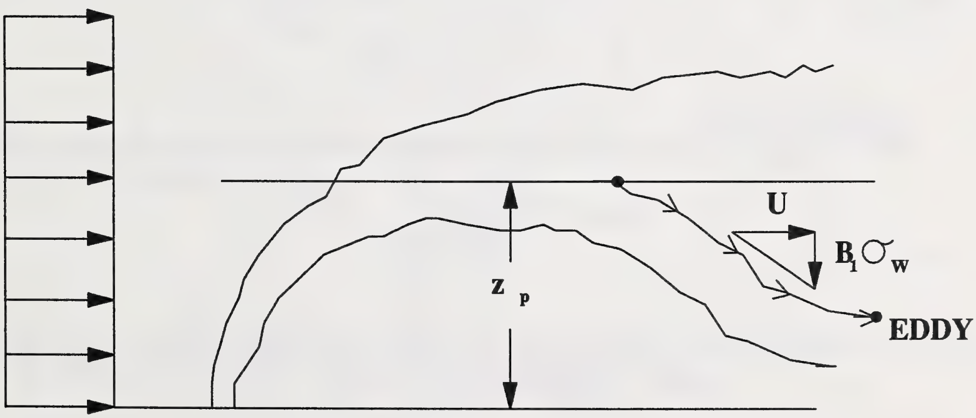

Figure D.2

Downwind Diffusion of a Plume in Uniform Homogeneous Turbulence

This implies that the plume grows linearly with downwind distance, $\sigma_z \propto B_1\sigma_W X$. This linear growth shows that the proposed time-of-travel diffusion model does not account for the effect of turbulence scale, which causes a gradual change from $\sigma \propto X$ near the

source to $\sigma \propto X^{1/2}$ far downwind. Considering that we are attempting to define an effective σ_W for a Gaussian profile that itself is only valid in uniform homogeneous turbulence, the failure of time-of-travel model to account for turbulence scale effects is not likely to be significant.

The vertical velocity of an eddy is from assumption 1.

$$\begin{aligned} \frac{dz}{dt} &= W \\ &= B_1 \sigma_W \\ &= 1.3 B_1 U^* \left(1 - \frac{z}{z_i}\right)^a \end{aligned} \tag{6}$$

Transposing and integrating to find the travel time t_{down} from the plume height $z=z_p$ to ground level, $z=0$,

$$\int_0^{t_{down}} dt = \int_{z_P}^{0} \frac{dz}{B_1(1.3U^*)\left(1 - \frac{z}{z_i}\right)^a} \tag{7}$$

To simplify the integral, use the direct substitution

$$\zeta = 1 - \frac{z}{z_i}$$

so that (7) becomes

$$t_{down} = \frac{z_i}{1.3 B_1 U^*} \int_{\left(1 - \frac{z_P}{z_i}\right)}^{1} \zeta^{-a} d\zeta$$

$$t_{down} = \frac{z_i}{1.3 B_1 U^* (1-a)} \left[1 - \left(1 - \frac{z_P}{z_i}\right)^{1-a}\right] \tag{8}$$

Then, defining an effective σ_{Weff} as the constant RMS velocity that produces the same travel time

$$t_{\text{down}} = \frac{z_P}{W_{eff}}$$

$$= \frac{z_P}{B_1 \sigma_{Weff}} \tag{9}$$

Equating (8) and (9) for equal travel times

$$\frac{z_P}{B_1 \sigma_{Weff}} = \frac{z_i}{1.3 B_1 U^*(1-a)} \left[1 - \left(1 - \frac{z_P}{z_i} \right)^{1-a} \right]$$

Transposing terms and noting that σ_W at z = 0 is

$$\sigma_{W0} = 1.3U^*$$

we obtain

$$\frac{\sigma_{Weff}}{\sigma_{W0}} = \frac{(1-a)\left(\frac{z_P}{z_i}\right)}{\left[1 - \left(1 - \frac{z_P}{z_i} \right)^{1-a} \right]} \tag{10}$$

It is easy to show that the effective velocity σ_V from (2) for crosswind spread follows exactly the same equation,

$$\frac{\sigma_{Veff}}{\sigma_{V0}} = \frac{\sigma_{Weff}}{\sigma_{W0}} \tag{11}$$

Also, note that (10) produces an undefined value of 0/0 for a ground level plume where $z_P = 0$. Again, it is easy to show that the limit is well behaved with

$$\lim_{z_P \to 0} \frac{\sigma_{Weff}}{\sigma_{W0}} = 1.0$$

As long as the lowest value used in the equation is some small non-zero value, such as $z_P = z_O$, the roughness length, a limit of 1.0 will result.

Because the advection velocity U of plume eddies varies with height, the trajectory of parcels of plume material will be complicated. A sketch of plume trajectories (not to scale) in Figure D.3 illustrates this

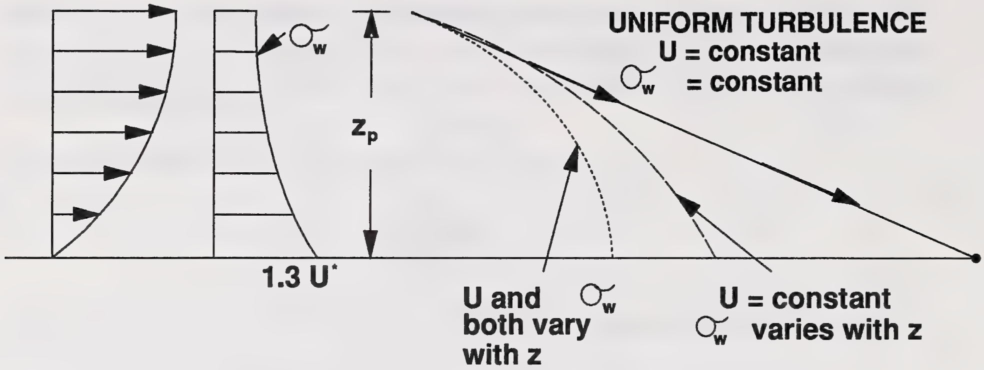

Figure D.3

Trajectories of Plume Eddies for Different Wind Conditions

The proposed model, which assumes wind speed U is constant with height, represents a compromise between a simple arithmetic average and the actual trajectory in a wind profile. Considering the simple linear time of flight model used, the extra complexity required to include a vertical wind profile did not seem justified.

It is interesting to compare the values of $\sigma_W/\sigma_{w_{z=0}}$ in (10) to the simple approximation using the arithmetic average in (5). Table D.1 shows this comparison for the entire range of plume heights, from a ground level plume to a plume which rises to the inversion height.

Table D.1
Comparison of Turbulence Velocity Ratios

$\frac{z_P}{z_i}$ PLUME HEIGHT T0 INVERSION HEIGHT RATIO	Equation (1) $\frac{\sigma_{WP}}{\sigma_{WO}}$ AT PLUME HEIGHT	Equation (5) $\frac{\sigma_{Wavg}}{\sigma_{WO}}$ ARITHMETIC AVERAGE	Equation (10) $\frac{\sigma_{Weff}}{\sigma_{WO}}$ TIME OF FLIGHT
0.0	1.000	1.000	1.000
0.1	0.924	0.962	0.962
0.5	0.595	0.798	0.786
0.9	0.177	0.589	0.514
1.0	0.000	0.500	0.250

The only significant difference between the arithmetic average and the time of flight model occurs very close to the inversion, when $z_P > 0.9\ z_i$. In this region, the turbulence is so small that a long time is required for a plume eddy to diffuse downward from the plume centreline.

References

Alp, E., Huget, R.G., Davies, M.J.E., and Lam, L.H. (1987) "A Model to Estimate Ground-Level H_2S and SO_2 Concentrations from Uncontrolled Sour Gas Releases" Technical Report to the Energy Resources Conservation Board, June 1987, p 93.

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References

Alp, E., Fraser, R.G., Davies, M.J.E., and Lam, L.H. (1987). "A Model to Estimate Ground-Level H_2S and SO_2 Concentrations from Uncontrolled Sour Gas Releases" Technical Report to the Energy Resources Conservation Board, June 1987, p.92.

U and σ_w both vary with z

U = constant
σ_w varies with z

Figure D.3

Trajectories of Plume Eddies for Different Wind Conditions

The proposed model, which assumes wind speed U is constant with height, represents a compromise between a simple arithmetic average and the actual trajectory in a wind profile. Considering the simple linear time of flight model used, the extra complexity required to include a vertical wind profile did not seem justified.

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0.0	1.000	1.000	1.000
0.1	0.924	0.962	0.962
0.5	0.595	0.798	0.788
0.9	0.177	0.589	0.514
1.0	0.000	0.500	0.250